625.06
INT
Cop. 2

VOL. XXXVIII. — No. 8. AUGUST 1961.

Monthly Bulletin of the International Railway Congress Association

(English Edition)

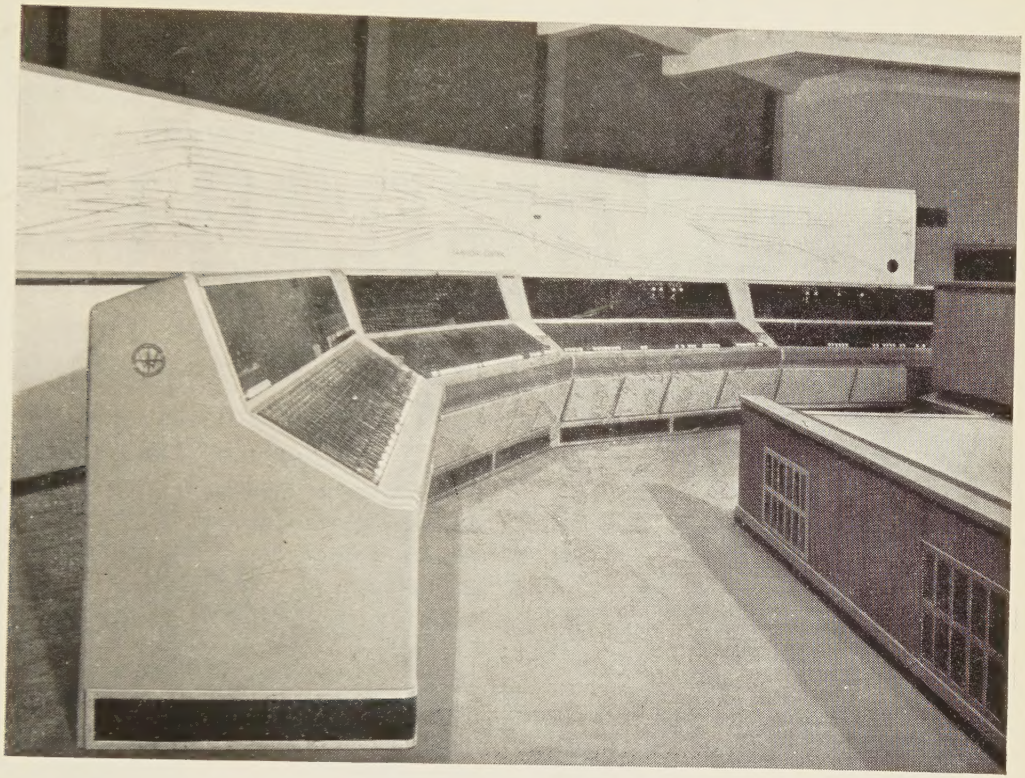
THE LIBRARY OF TH.
OCT 30 1961
UNIVERSITY OF ILLINOIS

Digitized by the Internet Archive
in 2024

https://archive.org/details/rail-international_1961-08_38_8

OVER 1,000 ROUTES
FROM ONE CONTROL DESK

GLASGOW CENTRAL
BRITISH RAILWAYS,
SCOTTISH REGION



With over 1,000 routes, believed to be the largest route relay interlocking in the world, operated from one control desk. It controls all functions as far as Larkfield Junction on the Main Lines and Cook Street on the Gourock Lines, comprising in this concentrated area approximately 11 miles of track, involving 90 main colour Light signals, 80 « West lyte » shunt signals and 157 sets of electro-pneumatically operated points. There are 243 track circuits, and miniature type plug-in relays have been used extensively.

BRITISH
DESIGN
AND
MANUFACTURE

WESTINGHOUSE

SIGNALLING FOR RAILWAY MODERNISATION

WESTINGHOUSE BRAKE AND SIGNAL CO. LTD., 82 YORK WAY, KING'S CROSS, LONDON N. 1.

Alphabetical Index of Advertisers

Firms :		Specialities :
A E I (Associated Electrical Industries Limited)	—	Traction problems.
Alsthom	VIII	Electric locomotives.
Belgian Railways	—	Car-sleeper-express.
Bell Telephone Mfg. Co.	IV	Automatic time-tables.
Beyer Peacock (Hymek) Ltd.	—	Diesel-hydraulic locomotives.
Cockerill-Ougrée (S.A.)	X	Steam and Diesel locomotives.
Edilon, N.V.	XII	Adhesive for modern concrete construction.
Electromécanique (S.A.)	—	Butt welding of rails.
English Electric Company Ltd. (The)	VII	Railway electrification.
Ericssons (LM) Signalaktiebolag.	—	Railway signalling.
Ganz-Mávag	—	Railway rolling stock.
General Motors Corporation	III	Diesel locomotives.
Hasler (A.G.)	VIII	Speed indicators and recorders.
Knorr-Bremse, G.m.b.H.	—	Air brakes.
Matisa Equipment Limited	VI	Permanent way equipment.
Metropolitan-Cammell Carriage & Wagon C° Ltd.	—	Lightweight railway coaches. Diesel locomotives.
Pressed Steel Co. Ltd.	—	Wagons.
R.I.V. (Officine di Villar Perosa)	—	Axleboxes.
S.A.B. (Svenska Aktiebolaget Bromsregulator)	XI	Automatic slack adjusters.
S.K.F. (Société Belge des Roulements à Billes)	Cover	Axleboxes.
Vapor International Corporation	—	Steam heating systems.
Werkspoor, N.V.	IX	Locomotives.
Westinghouse Brake and Signal Co., Ltd.	I	Railway signalling. Brakes.
Workington Iron & Steel Co.	V	Rails, fish plates, sole plates.

Most logical investment on railways—

GENERAL MOTORS LOCOMOTIVES

are built by the manufacturer with the most extensive experience in designing, building and servicing Diesel locomotives – more than 24,000 units now at work on six continents.

GENERAL MOTORS OVERSEAS OPERATIONS

Division of General Motors Corporation, New York 19, N.Y., U.S.A. Cable Address: Autoexport

ASSOCIATE BUILDERS: AUSTRALIA—The Clyde Engineering Co. Pty., Ltd., Sydney, N.S.W. • BELGIUM—LaBrugeoise et Nivelles, St. Michel-lez-Bruges GERMANY—Henschel-Werke, GmbH, Kassel • SOUTH AFRICA—Union Carriage & Wagon Co. (Pty.) Ltd., Nigel, Transvaal • SPAIN—Material y Construcciones, S.A., Barcelona • SWEDEN—Nydqvist & Holm Aktiebolag, Trollhattan

LOCOMOTIVE PLANTS: Electro-Motive Division of General Motors, La Grange, Illinois, U.S.A. General Motors Diesel Limited, London, Ontario, Canada

General Motors subsidiaries, branches or representation throughout the world

GENERAL MOTORS LOCOMOTIVES GM GENERAL MOTORS DIESEL POWER

World's Highest Standard – 270 to 2600 H.P.

15.23	PARIS	T.E.E	10
17.48	BERLIN	DIR	12
19.17	BALE	EXP	8
10.42	PRAGUE	DIR	16
11.19	WIEN	T.E.E.	21

"MULTICATOR" AUTOMATIC TIME-TABLES

The new centrally-controlled Multicator announcement system is based on a rationally designed series of mobile panel indicators securing utmost flexibility in planning, installation and operation.

Of standardized size and appearance, all existing types permit a harmonious and low-cost integration either into composite time-tables for main halls or into individual indicator-boards on the different platforms.

At the control desk, provision is made for the operator to continuously check the information shown on each individual Multicator unit.

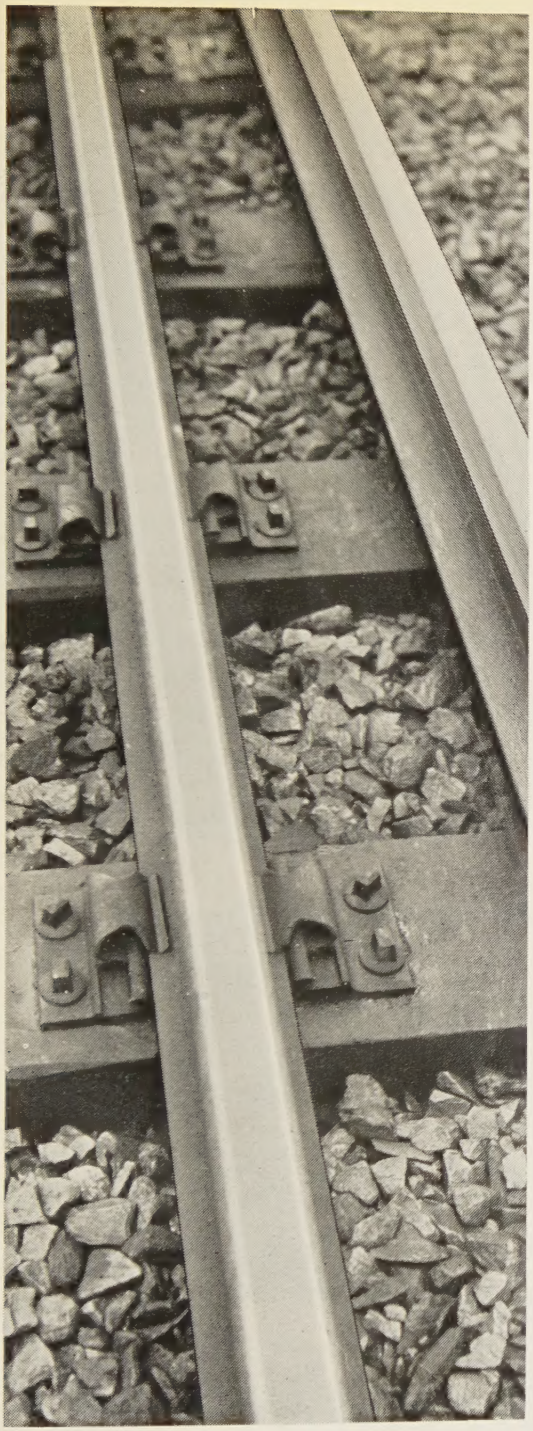
For full information on this matter kindly consult :

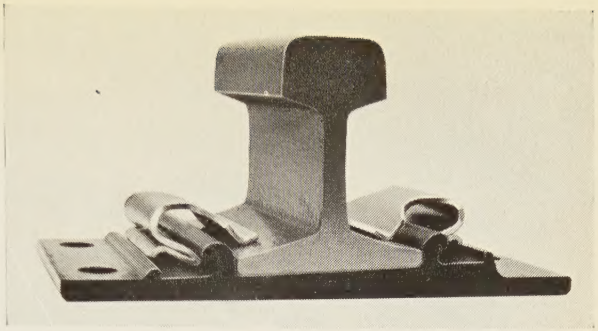
AN ITT ASSOCIATE

Bell Telephone Mfg Co

INSTRUMENTATION AND CONTROL DIVISION

1, FRANCIS WELLESPLEIN - ANTWERP-BELGIUM TEL. 37.78.00 TELEX. : 3-226 CABLE : MICROPHONE-ANTWERP





THE HEY-BACK RAIL FASTENING

The POSITIVE elastic fastening

The Hey-back Rail Fastening with its specially designed baseplate and spring clip provides an effective elastic fastening of the rail independent of the fixing of the baseplate to the sleeper. The fastening allows rails to be removed and replaced with speed and economy of labour. The fastening is adaptable to both wood and concrete sleepers, is simple and requires neither special tools nor skilled labour for fitting and maintenance.

The photograph on the left shows the Hey-back System in use near Neasden on an electric track of the London Transport Executive, whose permission to reproduce this photograph is gratefully acknowledged.

Further technical data gladly supplied on request.

WORKINGTON IRON & STEEL COMPANY

MAKERS OF RAILS, FISHPLATES, BASEPLATES AND STEEL SLEEPERS

A branch of The United Steel Companies Limited

THE UNITED STEEL COMPANIES LTD

WORKINGTON Phone: Workington 206 Grams: "Mosbay", Workington, Cumberland

Railway Department: 8/10 Grosvenor Gardens, Victoria, London, S.W.1 · Phone: Sloane 4533 · Grams: Unisteels, Sowest, London

Matisa *once again in the forefront of progress proudly present its latest product :*

THE TAMPER WITH AUTOMATIC LEVELLING

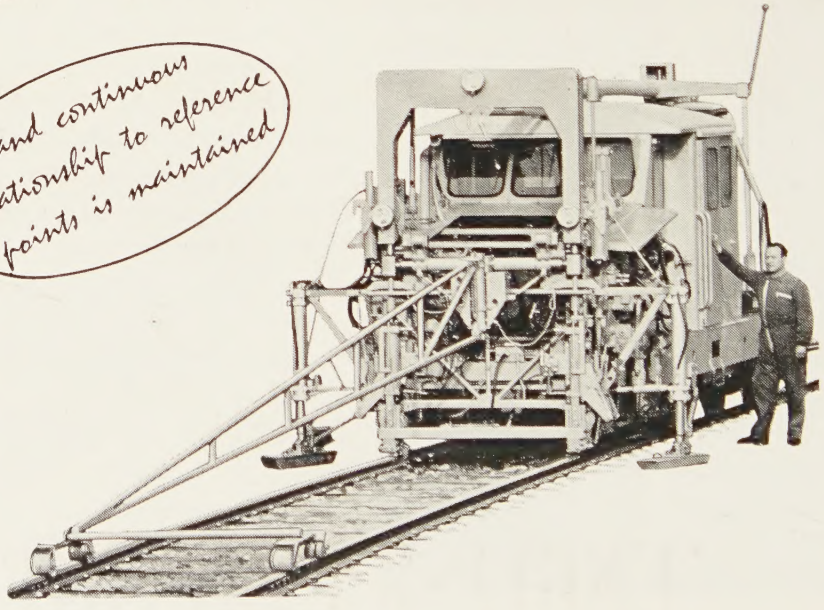
which has these characteristics

Precision : not approximation
Due to its rigid construction, distortion and vibration which tend to destroy precision, are eliminated, enabling the track to be levelled to limits of a millimetre*. This high degree of accuracy is obtained both on plain track and on curves.

Speed : A continuous rate of working of 400 metres (437 yards) of track levelled and tamped per hour is achieved with only two men, independent of weather conditions (wind, etc.).

Certainty : The ability to keep either a continuous or an intermittent check on the results avoids any variation from the required levels.

* *and continuous relationship to reference points is maintained*



TRACK MAINTENANCE SPECIALISTS ALL OVER THE WORLD

LICENSES FROM MATERIEL INDUSTRIEL S. A. LAUSANNE - SWITZERLAND

MATISA EQUIPEMENT LIMITED HANWORTH - LANE CHERTSEY - SURRE

Maximum Efficiency

over a wide range of operating conditions

Ten of these 'ENGLISH ELECTRIC' 1840 h.p., 1Co-Co1 diesel-electric locomotives, equipped with rheostatic braking, have been supplied to the East African Railways and Harbours.

Hauling 600-ton freight trains on the Nakuru—Nairobi route, the locomotives operate at altitudes ranging from sea-level to over 9000 ft., in temperatures between 35°F and 100°F and in conditions varying from drifting dust to heavy tropical rains.

'ENGLISH ELECTRIC'

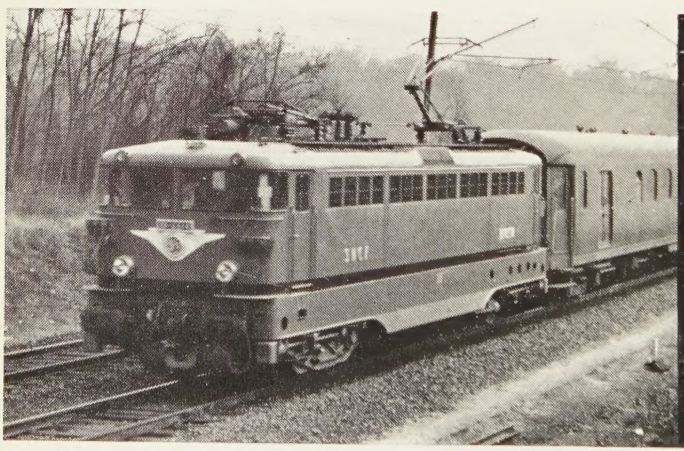
in association with

VULCAN FOUNDRY · ROBERT STEPHENSON & HAWTHORNS

TDD.89

TELOC Speed Indicators and Recorders are known and appreciated throughout the World, as they permit exact observing of speed regulations and therefore contribute to the safety of passengers. Further, valuable information is provided to the Railway Traffic Manager for the re-organisation and speeding up of services.

Hasler Ltd Berne



ALSTHOM
has built since 1949,

1 000
ELECTRIC
AND DIESEL-ELECTRIC
LOCOMOTIVES,

totalizing an output
of about
3 MILLIONS HP.

BB 16 500 locomotive. 3 500 H. P. 68 metric tons. French National Railways

ALSTHOM
TRACTION

38, AVENUE KLÉBER - PARIS

WERKSPOOR

Locomotives

for any

specific purpose

Werkspoor locomotive construction department, backed by many years of experience, is at your command, and will gladly co-operate in solving your problems.

Locomotives in great variety,
ranging from 300 to 2,300 h.p.,
are built by Werkspoor.
Recent deliveries include
Diesel-electric locomotives
Diesel-hydraulic locomotives
Electric locomotives.
For special requirements, Werkspoor
have also supplied
sparkless locomotives
for use in oil refinery yards, and
dustproof locomotives
for work on desert railways.
Many Werkspoor locomotives
are powered by diesel engines
of Werkspoor design
and manufacture.

WERKSPOOR

WORKS AT UTRECHT · HOLLAND

COCKERILL-OUGREE CONTRIBUTES TO THE MODERNIZATION OF RAILWAYS

With its complete line of diesel-electric locomotives ranging from 600 to 2000 HP, built under licence from Baldwin-Lima-Hamilton Corporation, specially engineered for passenger and freight service, COCKERILL-OUGREE has within its wide programme the precise unit which will perform economically and reliably any specific job under any conditions of climate and terrain.

Cockerill-Ougrée has also specialized in the production of diesel-hydraulic locomotives ranging from 200 to 800 HP

COCKERILL-OUGREE

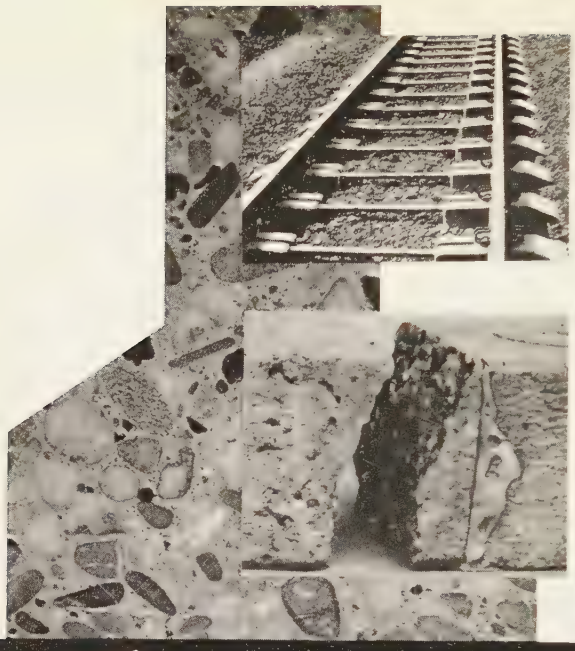
SERAING (Belgium)

SAB BRAKE REGULATORS

on Railways all over the world

BROMSREGULATOR

MALMÖ • SWEDEN



troublefree assembly

The skilful blend of raw materials makes Edilon P 5001 the essential adhesive for modern concrete construction. Edilon P 5001 has a high tensile, compression and shearing strength. Its tremendous adhesive power and its internal cohesion are greater than those of concrete itself.

As soon as Edilon P 5001 is applied, a hardening process is set up which continues uniformly, without forming any gases or secreting any liquids, even if the surfaces being assembled are extensive or hermetically sealed. Numerous tests have proved conclusively the advantages of Edilon P 5001. Its usefulness has been proved in practice in innumerable cases already.

stronger than concrete

edilon

P 5001

quick and easy to use

rapid and economic assembly

THE CHARACTERISTICS OF EDILON P 5001 ARE :

Tensile strength (after natural setting)	200 kgr cm²
Tensile strength (after artificial setting)	350 kgr/cm²
Bending strength	350 kgr cm²
Compression strength	1500 kgr cm²
Modulus of elasticity E	75000 kgr/cm²
Adhesive strength on steel (pull)	200 kgr/cm²
Adhesive strength on steel (shear)	250 kgr cm²

LIMITLESS POSSIBILITIES OF USE

EDILON N.V., Spaarndamseweg, 214, Haarlem (Holland). Tel. 55542

MONTHLY BULLETIN

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(ENGLISH EDITION)

PUBLISHING and EDITORIAL OFFICES : 19, RUE DU BEAU-SITE, BRUSSELS

Price of this single copy : 80 Belgian Francs (not including postage).

Yearly subscription for 1961 { Belgium . . . . . 700 Belgian Francs
Universal Postal Union . . . 800 Belgian Francs

Subscriptions and orders for single copies to be addressed to the General Secretary, International Railway Congress Association, 19, rue du Beau-Site, Brussels (Belgium).

Advertisements : All communications should be addressed to the Association, **19, rue du Beau-Site, Brussels (Telephone No. 47.53.35).**

CONTENTS OF THE NUMBER FOR AUGUST 1961.

CONTENTS	Page.
I. The new rail fastening of the Netherlands Railways, by J.F. DEENIK and J. A. EISSES	525
II. Mechanographical treatment of the transport papers for part loads on the Belgian National Railways, by M.L.F. SCOUMANNE	537
III. Examination of trains in motion at the Pierrelatte station (Paris-Marseilles line), by M. GARIBALDI	552
IV. Electrostatic influences affecting the dirt collecting propensities of passenger coaches, by H.F. SCHWENKHAGEN	569
V. The new organisation of the restaurant services on S.N.C.F. trains for large groups of passengers	587
VI. Automate production of concrete ties, by C.W. DONNELLY	589

CONTENTS *(continued)*.	Page.
VII. Official Information issued by the Permanent Commission of the International Railway Congress Association :	
Meeting held by the Permanent Commission, in Brussels, on June 2, 1961	591
Appendix : List of Members of the Permanent Commission	596
VIII. New Books and Publications :	
125 Jahre Deutsche Eisenbahnen. Sonderausgabe der « Eisenbahntechnische Rundschau »	600
IX. Monthly Bibliography of Railways	93

LIBRARY

OF THE

Permanent Commission of the International Railway Congress Association

READING ROOM : 19, rue du Beau-Site, Brussels.

Works in connection with railway matters, which are presented to the Permanent Commission are mentioned in the « Bulletin ». They are filed and placed in the library. If the Executive Committee deems it advisable they are made the subject of a special notice. Books and publications placed in the reading room may be consulted by any person in possession of an introduction delivered by a member of the Association.

Books, etc., may not be taken away except by special permission of the Executive Committee.

All original articles and papers published in the « Bulletin » are copyright, except with the consent of the Authors and the Committee.

The Permanent Commission of the Association is not responsible for the opinions expressed in the articles published in the « Bulletin ».

An edition in French is also published.

Vol. XXXVIII. — No. 8. August 1961.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[625 .143 .5 (492)]

The new rail fastening of the Netherlands Railways,

by J.F. Deenik, Chief Engineer,

and J.A. Eisses, Engineer,

of the Netherlands Railways.

History.

For nearly fifty years, the Netherlands Railways (N.S.) have used on their main lines a fastening of the independent type, consisting of a cast iron sole plate fastened to the wooden sleeper by 4 coach-screws on which the rail is fixed by 2 clips tightened up by bolts. To begin with, no type of packing was used between the foot of the rail and the sole plate; but since 1950 the rail has been laid on a poplar wood packing.

In the meanwhile, a type of rolled sole plate, based on the same principle as the cast iron sole plate, had been introduced in Germany; this sole plate held the foot of the rail between 2 projecting ribs in which half-moon openings were cut, intended to hold the heads of the bolts. When the N.S. were sure that these rolled sole plates were just as good economically and technically, in fact even better than the cast sole plate, they adopted the German design.

New modifications.

It ought to be possible to lay a modern track with long welded rails, and the maintenance costs, consisting mainly of the labour charges, which during recent years have increased more than the value of the materials used, must be kept as low as possible.

In order to increase safety against lateral displacement of long welded rails, it is important to make sure that the foot of the rail is properly tight on the sole plate.

On both cast iron and rolled sole plates, the fastening of the rail depends on the locking force of an elastic washer fastened by a bolt. The force exerted by a 7/8″ (22 mm) bolt on the washer and thereby on the clip, does not exceed 3 000 kg. Half of this effort, i.e. 1 500 kg is transmitted by the clip, in such a way that it is possible to hold the foot of the rail with a force of $2 \times 1\,500 = 3\,000$ kg in all; this is sufficient in

particular to prevent any longitudinal creep of the rail on the sleeper.

If it were merely a question of fastening the rail on the sleeper sufficiently tightly for the displacement of the sleeper in the ballast, in the longitudinal direction of the track, to be easier than for the rail to slip in its fastening, experience would show that the fastening of the rail to the soleplate is quite sufficient. In practice, however, it is necessary to take into account the fact that an elastic washer, when it becomes slightly loose, has already lost a very considerable part of its locking force : if it is only 1 mm undone, which easily happens owing to the wear of the parts in contact or to deformation of the wood packing, the locking force is reduced by half. As a result, it is necessary to tighten up the bolts periodically.

As there is always a fear that the fastenings are not tight enough, and because of the cost of repeated tightenings up, attempts have been made to find a more reliable device to take the place of the clip-bolt-elastic washer system. In itself, the independent fastening on cast iron or rolled sole plates has certain very valuable qualities, namely :

Fig. 1.

— mechanised fastening on the sleepers in the shops;

— ease with which the rails can be put in the correct position on the line;

— ease with which the rails can be replaced if necessary.

Replacement of the clip and the bolt.

At first, there was no question of replacing the sole plates by some other

part, especially as it had already been discovered that the life of a sole plate is greater than that of a wooden sleeper, so that this accessory can usefully be recovered for re-use when the sleepers are renewed. Attempts were therefore made to perfect a device which could take the place of the clip-bolt-washer system without modifying the sole plate in any way, which whilst keeping the rail tight against its support would assure that the locking force was less sensitive to the effects of wear or deformation of the wood bearing plates. The fact that no alterations were made to the sole plate meant that they were free to retain the old device or make use of the new one as they pleased.

The new device is a curved stirrup of spring steel, which is shown ready for use in figure 1.

Figure 2 shows how the claws, after having been closed up by tongs, are slid towards the rail through the upwardly sloping opening in the rib until they make contact with the foot of the rail, whilst the lower part, which is bent over in a loop, engages in the hollowed out part of the opening in the rib. With the assistance of a hammer and set — unless mechanical tools are available — the flat part of the loop is forced into the opening in the rib (fig. 3); the claws which are already in contact with the foot of the rail, slide over its inclined surface and so lift up, whilst the loop, which fits without play into the opening, tends to oppose this movement. The deformation of the whole of the stirrup puts it under stress and thus holds the foot of the rail onto its seat.

Fig. 2.

Fig. 3.

Fig. 4.

The claws are so shaped that as soon as their ends reach past the width of the rib they expand by separating transversally, thus getting a grip upon the back of the rib, which prevents them from coming back (fig. 4). To remove them

Fig. 5.

Fig. 6.

it is necessary to use tongs by means of which the ends are forced together, and a special lever (figs. 5 and 6) which enables the stirrup to be withdrawn.

Design and inspection.

The form of the fastening depends upon the way it is put into place and the dimensions of the openings into

which the stirrup has to be inserted. The exact dimensions of the stirrup are fixed by the force to be attained in application and the deformation laid down; the maximum stress in the parts making up the stirrup must remain well within the elastic limit, whilst assuring a rational use of the material in use.

The condition imposed as regards the force exerted in application was 1 000 kg per stirrup, which might drop to 800 kg so that there was a certainty of always having a thrust of at least 1 500 kg at each fastening point.

With a bar of 12 × 14 mm section, it was found possible to make a stirrup which would more or less meet these desiderata.

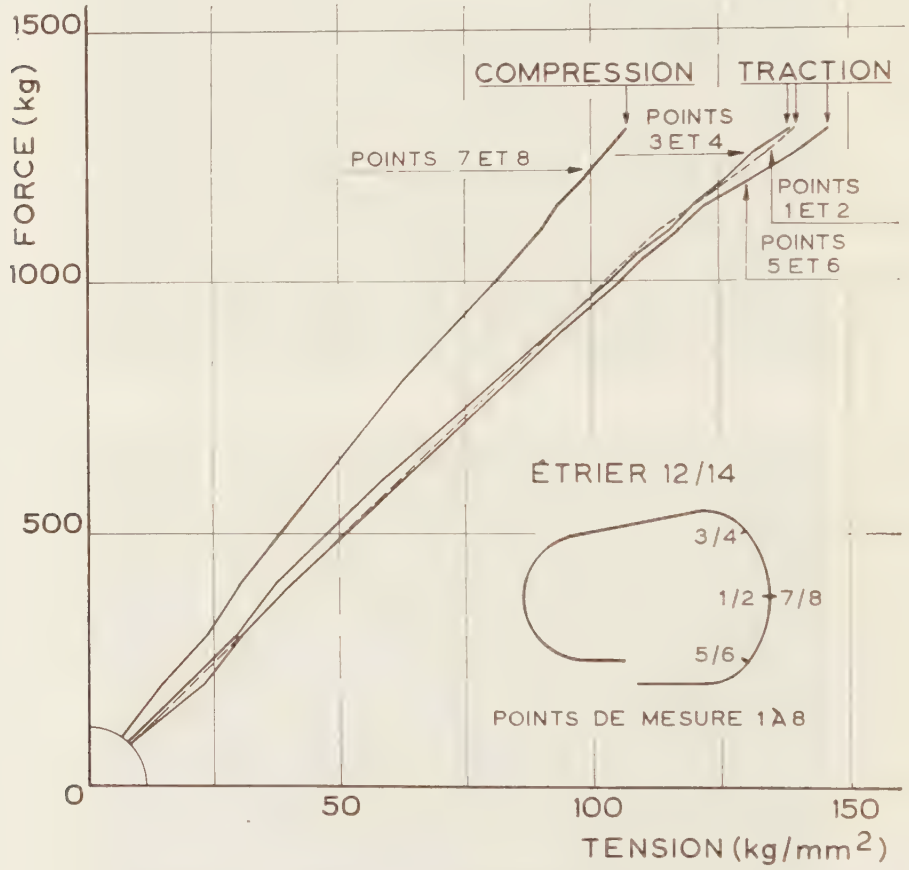


Fig. 7. — Results of the measurements of the stresses.
N. B. — Etrier = stirrup. — Points de mesure 1 à 8 = measuring points 1 to 8.

Figure 7 shows the results of measurements of the stresses carried out by means of ohmic extensometers : with an effort of 1 000 kg the extension stress in

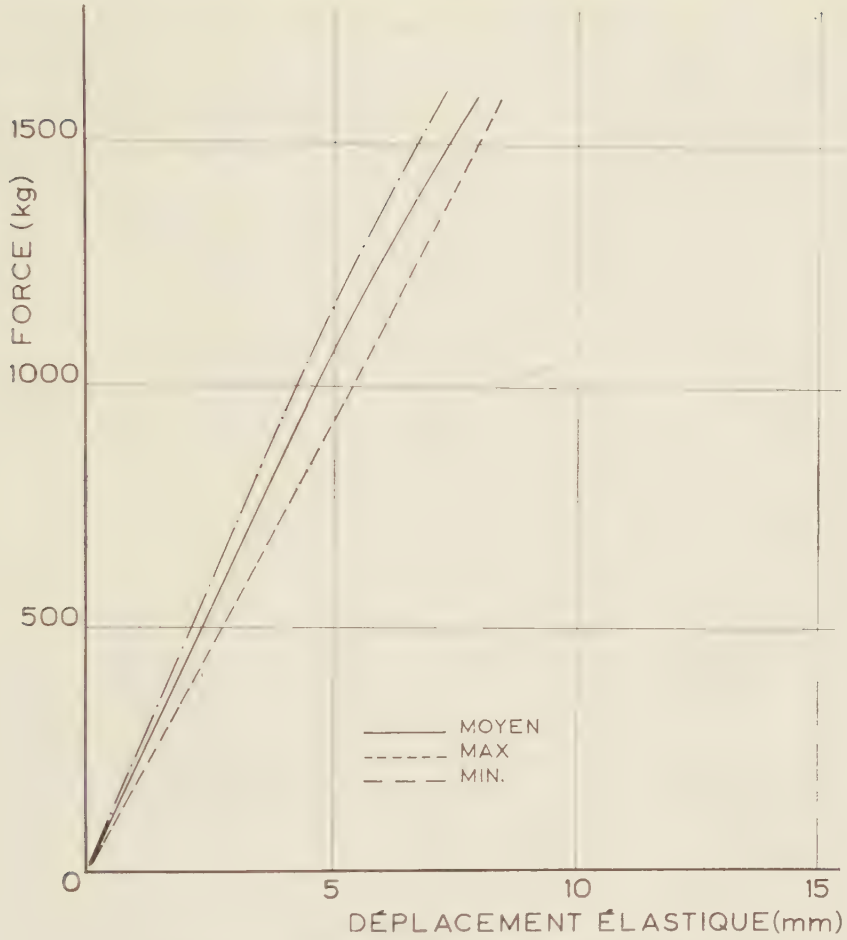


Fig. 8. — Elastic characteristic of a stirrup 12/14.

———— average.
- - - - - - - maximum.
— . — . — minimum.

N. B. — Déplacement élastique = elastic movement.

the rear curve amounted to 105 kg/mm². The form of this curve is such that the stresses are more or less constant over its whole extent, which is a proof that the material has been rationally used. Under a load of 1 300 kg, permanent deformation is observed; the extension stress then amounts to 146 kg/mm².

In 1958, the device was slightly modified, and was subjected to tests at the Institute of Railway & Road Construction at Munich. The results were given in a report, the essentials of which can be summed up as follows :

1) determination of the elastic characteristics (fig. 8). Up to 1 500 kg per

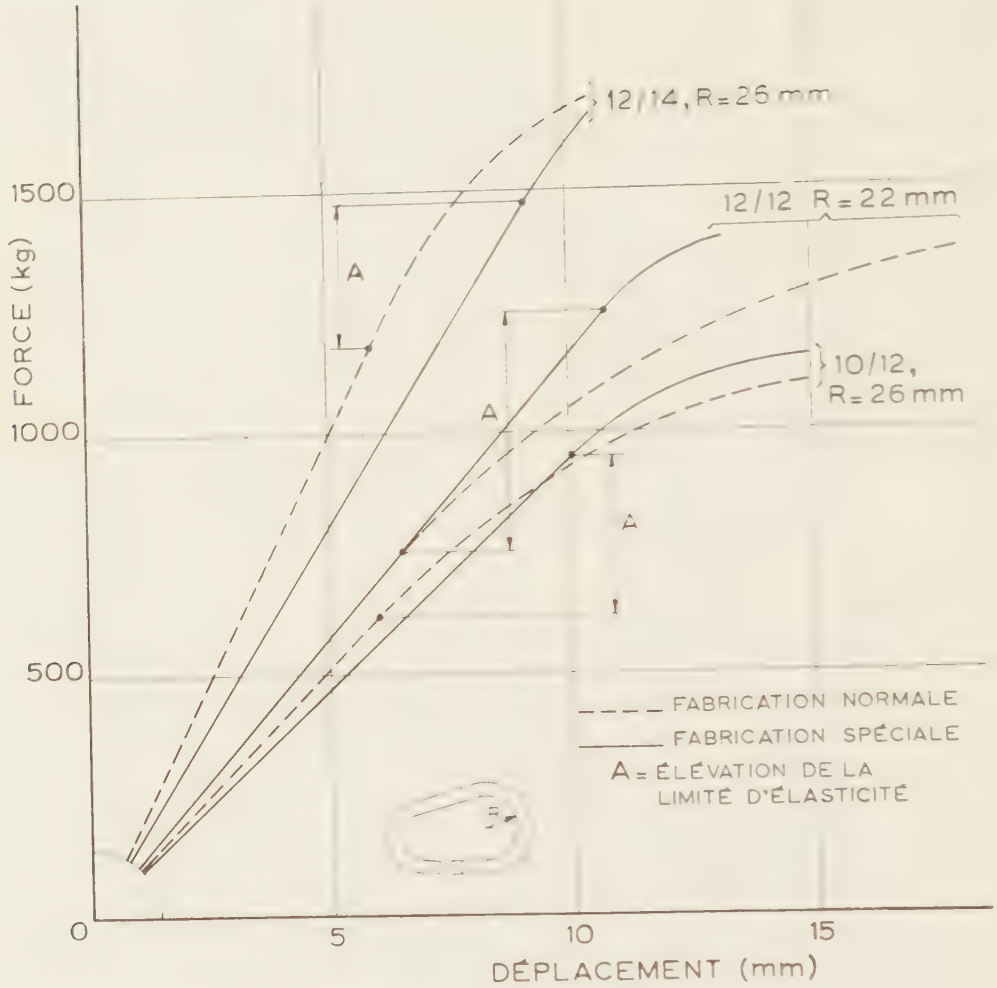


Fig. 9. — Characteristics of the different types of stirrups.

– – – – standard manufacture.
——— special manufacture.
A = increase in the limit of elasticity.

stirrup, no permanent deformation was observed;

2) fatigue stresses on a stirrup :

Alternating load varying between 1 375 and 1 500 kg, 1 500 alternations a minute, variation in deflection of 0.7 mm.

The test was stopped after 5.4 million alternations. The elastic characteristic after the fatigue test showed no permanent deformation up to 1 500 kg;

3) fatigue tests on a complete fastening :

Force of application 1 450 kg per stirrup, the elastic deformation did not exceed 1 mm.

The tests were stopped after 2.6 million alternations, without any defect having been noted.

of sole plates with ribs using on the one hand a clip-bolt-elastic washer system, and on the other the new elastic stirrups, showed that the creep efforts under pulsating forces remained more or less constant when elastic stirrups were used,

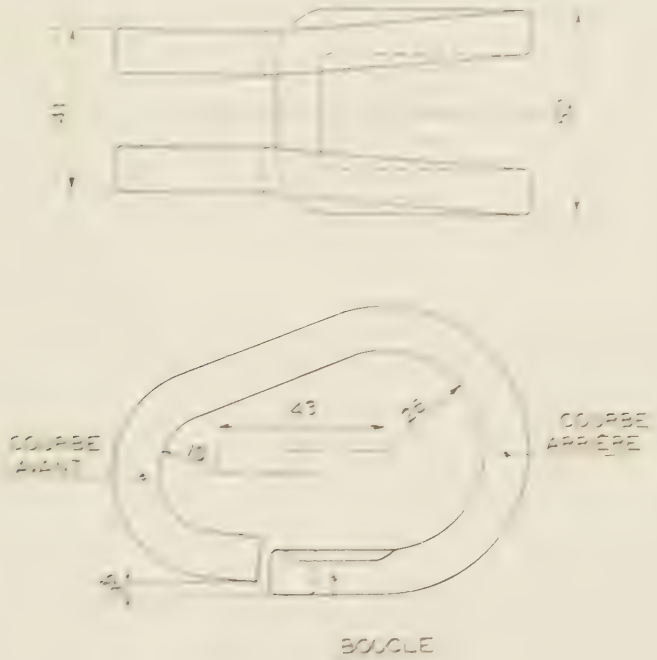


Fig. 10. — 12/12 stirrup.

N. B. — Courbe avant = front curve. — Courbe arrière = rear curve. — Boucle = loop.

4) tests of the creep under the effect of static and pulsating forces :

It appeared that under a static force, creep occurred when this force reached 50 % of the locking force of the stirrup; with pulsating forces, this proportion was reduced to 47 %.

In 1959, the tests carried out at the laboratories of the Western Region of British Railways on fastenings comprising

whereas they tended to diminish when the device with clips and bolts was used.

The locking effort of the bolts depends to a very great degree on the screwing moment.

An examination of figure 8 shows that the elastic constant is high. It appears that a deflection of not more than 5 mm for a load of 1 000 kg is too little.

The deformability had therefore to be

increased, and a compression stress of 1 000 kg was imposed for an average loss of deflection of 2 mm. The studies made led to the following conclusions :

Fatigue tests were carried out on 2 linked stirrups of this design.

They were put in position with 10 mm deflection. The pulsation was carried out with an amplitude of 0.5 mm (between 9.5 and 10 mm) at 250 variations per minute.

After 8 million pulsations, the test was stopped; no permanent deformation was found.

Figure 9 gives the characteristics of the various types of stirrups.

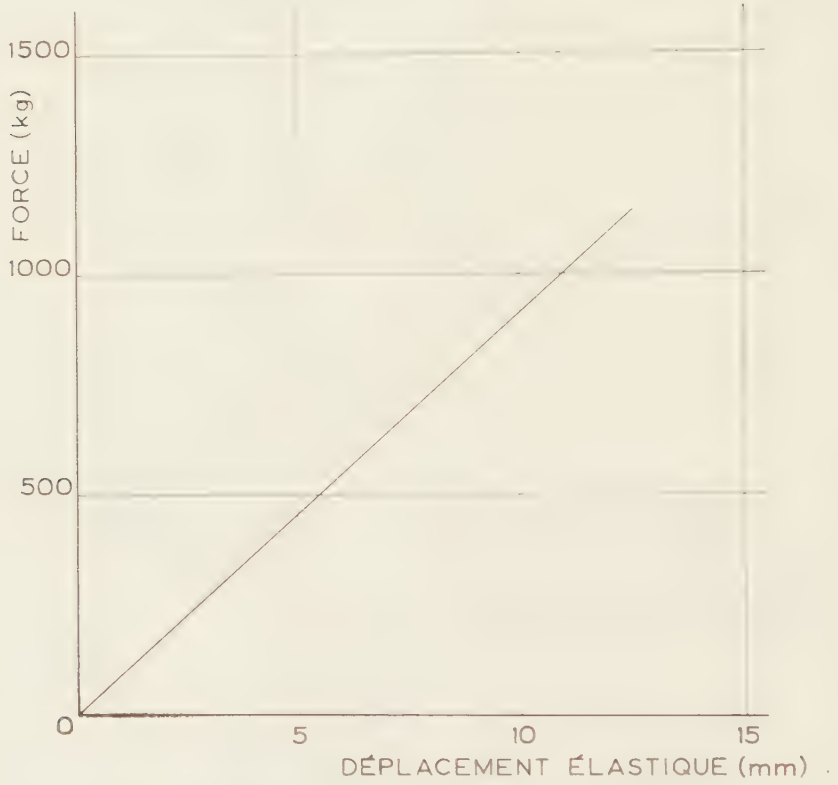


Fig. 11. — Elastic characteristic of a 12/12 stirrup for use with ribbed sole plates.

N. B. — Déplacement élastique = elastic movement.

1) a considerable increase in the deflection can be obtained with springs of 12×12 dimensions;

2) a special method of manufacture increases the limit of elasticity; this makes it possible to obtain the desired compression stresses.

Results.

Figure 10 shows the stirrup that resulted from the investigations briefly described above for use with ribbed sole plates; its elastic characteristic is reproduced in figure 11.

It will be noted that the deformation has been considerably increased and that, if the stirrup is fitted with a thrust of 1 000 kg, shortening it by 2.5 mm only reduces the thrust to 800 kg.

Fastenings for concrete sleepers.

In 1956, various circumstances prevented the N.S. from getting sufficient quantities of sleepers for service sidings; consequently they made concrete sleepers of the mixed type and designed a suitable fastening for them.

The guiding idea of the system adopted is as follows. The simplest fastening used with wooden sleepers consists of making a notch the size of the foot of

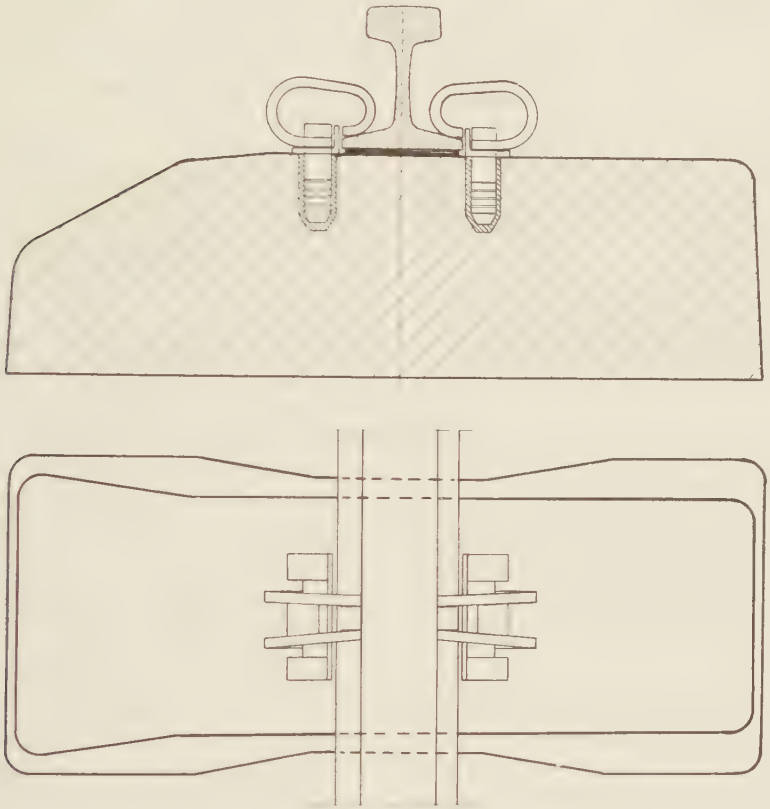


Fig. 12. — Stirrup used with concrete sleepers.

the rail, in which the latter is held laterally; fastening is by means of 3 coachscrews.

A similar notch in the concrete involved manufacturing complications and the use of a special sole plate, relatively costly to put under the rail. However, 2 clips placed on the two edges of the foot, with coachscrews passing through them into hollows made in the surface of the concrete in which they gripped by means of claws, held the rail both vertically and transversally and were very close to the simple type of fastening used with wood sleepers.

The wooden peg embedded in the concrete, so widely used in Germany, was just right for the fastening in question.

Attempts were made, however, to replace this by a peg made of synthetic materials. However, synthetic materials are not even in the running with wood in the economic field, and exercise a great expansion force on the concrete, which makes it necessary to reinforce it by bonding.

In order to reduce to the minimum the consumption of material and avoid cracks due to expansion, the use was considered of a liquid filler during manufacture which would harden subsequently and adhere to both the steel and the concrete.

Application of stirrup to concrete.

Concrete has a sufficiently hard and smooth surface to take the load of the rail; it is advisable, however, to insert an elastic bearing plate, which at the present time is generally made of grooved rubber about 4 mm thick. There is no point therefore in using a metal sole plate, as in the case of wood, in order to obtain the advantages of an indirect fastening.

This led to the use with concrete sleepers of the elastic stirrup devised for ribbed sole plates.

With the collaboration of the manufacturer, the N.S. have perfected a synthetic glue called « Edilon », which assures the fixing of metal parts in the holes made for them in the concrete. In this way, along the two edges of the foot of the rail stops have been provided for the horizontal bedding and a hole for the vertical bedding of the stirrup (fig. 12).

Gluing the fastenings has 2 great advantages compared with sealing them into the concrete itself :

— the dogs can be positioned very accurately;

— gluing assures perfect electrical insulation in a position to which destructive outside factors have no access.

In this way, the N.S. have obtained an elastic fastening of similar design for both wood, steel and concrete sleepers.

[656 .212 .7 (493)]

Mechanographical treatment of the transport papers for part loads on the Belgian National Railways,

by M.L.F. SCOUMANNE,

Inspecteur Technique Principal à la Direction de l'Exploitation de la S.N.C.B.

The parcels traffic with the collection and delivery services for the Brussels region and certain nearby centres is assured by the Station of Brussels Tour et Taxis.

From the industrial point of view, the city is characterised by the numerous processing and finishing factories. Its population amounts to some 1 200 000.

The station of Brussels (T.T.) assures a departure service with a collection service, an arrival service with a delivery service, and a transhipment service.

The « departure » operations, being the only ones dealt with mechanographically, will be considered more particularly.

The figures given below characterise, first of all, the importance of the traffic with which this station has to deal.

	Average	Peak
Daily tonnage :		
a) collected	400 t	441 t
b) brought to the station	89 t	96 t
c) total	489 t	537 t
Corresponding number of consignments :		
a) collected	14 000	18 498
b) brought to the station	1 400	2 400
c) total	15 400	20 898

These figures show that 80 % of the outwards traffic is collected by the railway.

Brussels (T.T.) assures the delivery and collection services by means of a fleet of one hundred eighty-eight 4 to 6 t. lorries. The region is subdivided into 86 sections. Each of these is served daily by at least one lorry which delivers the parcels that have come in and picks up those to go out. As however the tonnage of goods arriving is only 50 %

of that leaving, this is not sufficient to collect all the goods for dispatch. Additional runs to collect goods from the premises of the larger clients are organised every day.

The greater number of business clients prefer to have the lorries collecting their goods arrive towards the end of the working day, i.e. between 16 and 17 h. In this way, they are able to fill orders received during the day.

It goes without saying that it would be impossible to satisfy them completely in this way without increasing the number of lorries used, which would all have to return to the station around 18 h. The capacity of the installations would not be adequate for dealing with the peak which would then occur under satisfactory working conditions. However, everything possible is done to meet the wishes of the more important clients, which already causes the peak traffic shown in the following table :

	Before 12 h	From 12 - 14	From 14 - 16	From 16 - 17	From 17 - 18	From 18 - 19	After 19 h
Number of lorries coming into the station . . . . . (Day of the 14-10-1960)	6	16	41	36	60	42	6

The trains run at night to transport this parcels traffic towards the provincial road centres leave Brussels (T.T.) at the following hours :

Direction	Ostend	Arlon	Charleroi	Liege	Antwerp	Namur	Mons
Hour of departure. . . .	23.07	22.47	0.30	23.56	23.39	0.47	2.36

Dealing with the documents accompanying the consignments involves the following operations :

a) checking the document and indicating the road centre to which the consignment is to be forwarded (allocation);

b) calculating the transport charges and determination of any supplementary charges. Calculation of the total sum to be charged;

c) preparing, for each consignor, a statement of the consignments sent during the same day. This statement is sent to the client on the following day by the lorry serving the section in question;

d) checking the accounts at the end of the day. The total of the charges on the statement must agree with the total charges shown on the documents;

e) allocating the transport documents

for each destination road centre and drawing up a statement of consignments per wagon leaving.

These operations can only be started when the lorries come in, and should be completed in sufficient time for the documents to be sent with the consignments or even to procede them by passenger train, to facilitate the work on arrival.

In fact, this was not always an easy matter to arrange. Peak traffics, delays in the return of the lorries, mistakes in the accounts to be checked at the end of the day, were enough to cause delays in sending out the documents, which thus only arrived at destination after the parcels.

Being anxious to standardise the work and put an end to the difficulties caused by such delays, at the provincial road centres, the S.N.C.B. decided to make use of the possibilities of mechanography and electronics. A thorough study of the work undertaken by the firm of « Bull » in collaboration with the staff of the Organisation Office of the Operating Department and the station staff, has made it possible to mechanise these operations completely.

* * *

The mechanographical work in connection with the documents is described below :

A. **Material used.**

Mechanographical and electronic equipment.

1) 8 visible card perforators;

2) 5 visible card verifiers;

3) 1 Gamma electronic computer with magnetic drum. 40 track drum giving 5 120 twelve figure stored memories;

4) 1 reading off and perforating unit connected to the Gamma; Maximum cadence : 7 200 cycles/h;

5) 2 tabulators, with 102 marking wheels, 9 000 cycles/h; one of the tabulators is connected to a punching machine for preparing the recapitulative cards;

6) 2 interpreters, 3 600 cards an hour, 4 lines of print;

7) 1 two track reproducer, 7 200 cards an hour;

8) 2 sorters, 42 000 cards an hour.

N.B. — The 2 tabulators, the reproducer and one of the sorters are so equipped as to be able to deal with smaller cards, only 2/3rd of the length of the normal cards (51 columns).

Auxiliary equipment :

1) 1 cutter, the length of the cut being controlled by a photoelectric cell;

2) 1 microfilm apparatus with film reader. Photographic cadence : 20 000 cards an hour. Possibility of obtaining photocopies of the documents;

3) 1 precision cutting machine;

4) 2 stamping machines with controlled counting, 18 000 cards an hour. Fig. 1 shows the room in which the large machines are installed, and fig. 2 the room in which the perforations and verifications are made.

B. **Organisation of the work.**

The new transport document consists of a mechanographical card of the usual

Fig. 1.

Fig. 2.

form with 80 columns. It is brown for express consignments, green for postal packets and yellow for fast traffic (fig. 3).

It is drawn up in the ordinary way by the client, one card for each consignment, no matter how many parcels there are.

Before they are given to the client by the station, the cards are perforated :

— with a three figure number, intended to identify the consignment;

— in the case of clients having an account with the station, with the number of the account;

— with a code figure indicating the service to be used.

The first two indications appear not only from the perforations but also in writing when the client stocks up with cards. The third indication is of no interest to him. The colour of the card is the basis of his choice.

The card has three sections which have been designated A-B-C to assist in understanding what follows.

The documents are dealt with according to the following processus :

1. *Grouping the documents.*

All the transport documents collected during the collecting services are taken to the mechanographical centre as soon as the lorries return to the station.

Documents accompanying consignments for abroad are not dealt with in the machines, but sorted out and sent to be dealt with manually.

The whole of the mechanographical cards collected by a lorry driver form a unit of work known as a « farde ».

2. *Preparation of the cards.*

Certain information given in the ordinary way by the client has to be coded in order to get ready for the work of perforation :

a) the name of the commune in which the consignee lives. This factor is coded in the form of a number of 1, 2 or 3 figures;

b) the method of consigning chosen by the consignor, 1 figure :

— carriage paid delivered home;

— carriage paid to await collection;

— carriage forward delivered home;

— carriage forward to await collection.

c) any special indications, such as requests to weigh, transport by container, return of empties, etc.

3. *Perforation.*

All the indications appearing in the ordinary way on the card and characterising the consignment are perforated (codified data, number of parcels, any sums to be collected for repayments or excess charges).

In order to facilitate the work, these data have been collected together on part B.

4. *Verification.*

The perforations, other than those previously made when the cards were put on sale, are verified. Cards with errors in perforation are put aside, though they are still included in the « farde ».

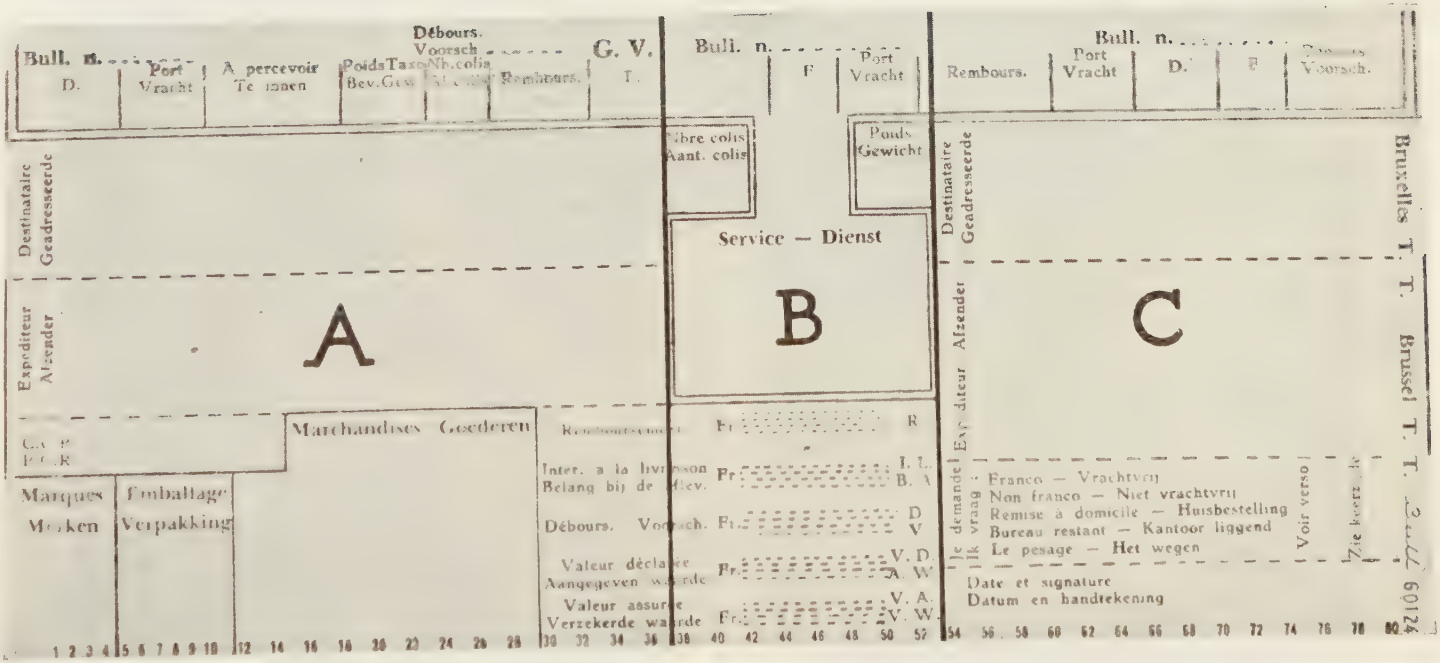

Débours.
Voorsch.
Bull. n.
D.
Port
Vracht
A percevoir
Te innen
Poids
Bev.Gew.
Taxe
Nb. colis
Remb.
G. V.
T.
Bull. n.
F
Port
Vracht
Rembours.
Bull. n.
Port
Vracht
D.
Voorsch.
Destinataire
Geadresseerde
Libre colis
Aant. colis
Poids
Gewicht
Service — Dienst
Bruxelles T. T. Brussel T. T.
Expéditeur
Afzender
A
B
C
Marchandises Goederen
Marques
Merken
Emballage
Verpakking
Inter. à la livraison
Belang bij de lev.
Débours. Voorsch.
Valeur déclarée
Aangegeven waarde
Valeur assurée
Verzekerde waarde
Je demande
Ik vraag
Franco — Vrachtvrij
Non franco — Niet vrachtvrij
Remise à domicile — Huisbestelling
Bureau restant — Kantoor liggend
Le pesage — Het wegen
Voir verso
Date et signature
Datum en handtekening
1 2 3 4 5 6 7 8 9 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80

Fig. 3.

5. *Correction of cards with errors.*

As the card is the transport document it must neither be destroyed nor replaced by another card.

In case of error, a companion blind card is prepared which travels with the wrongly perforated cards over the whole mechanographical chain. The blind card shows the correct perforations. A special conventional perforation instructs the machines to make use of the data on the blind card only, but to register the results, both in the ordinary way and by perforation, on the original document.

6. *Carrying out of sorting. Calculation of the charges.*

These operations are carried out by the electronic machine reading off and perforating unit and the Gamma extension drum. The apparatus perforates the results on the cards. Certain data such as the weight, number of parcels, transport rates, are totalised for each « farde » and perforated on a « results » card previously put at the end of the series.

7. *Interpretation.*

It is as well for the factors on which the charges are based, and also the results obtained, to appear on the transport document, not only as a perforation but also in writing.

The client in this way can check the document to some extent, and the arrival station itself has all the information it needs for delivering the parcel to the consignee.

Interpretation takes place on a single horizontal line in the upper part of the card, under the line of perforated data.

The interpreted card has the form shown in fig. 4.

8. *Microfilming.*

Always keeping to the same order in which they were arranged in the series (farde), the cards are microfilmed. The number of the series (F) serves as a reference number for subsequent investigations.

In case of litigation or loss during transport, the card can be duplicated with all its data.

9. *Dividing up.*

Part A of the card will be handed to the consignee when the consignment itself is delivered.

Part B will be retained in the archives of the destination road centre. This part has on the back, the signature of the consignee, acknowledging receipt of the consignment.

Part C is forwarded to the consignor as a receipt.

* * *

As part C is no longer of any interest for the remainder of the mechanographical work, it is cut off by the divider.

As soon as the work of perforation has been completed, the perforators sort these parts per consignor and append them to statement D.C. 1957 which will be described later on.

The mechanographical work continues on the remaining 2/3rd of the card

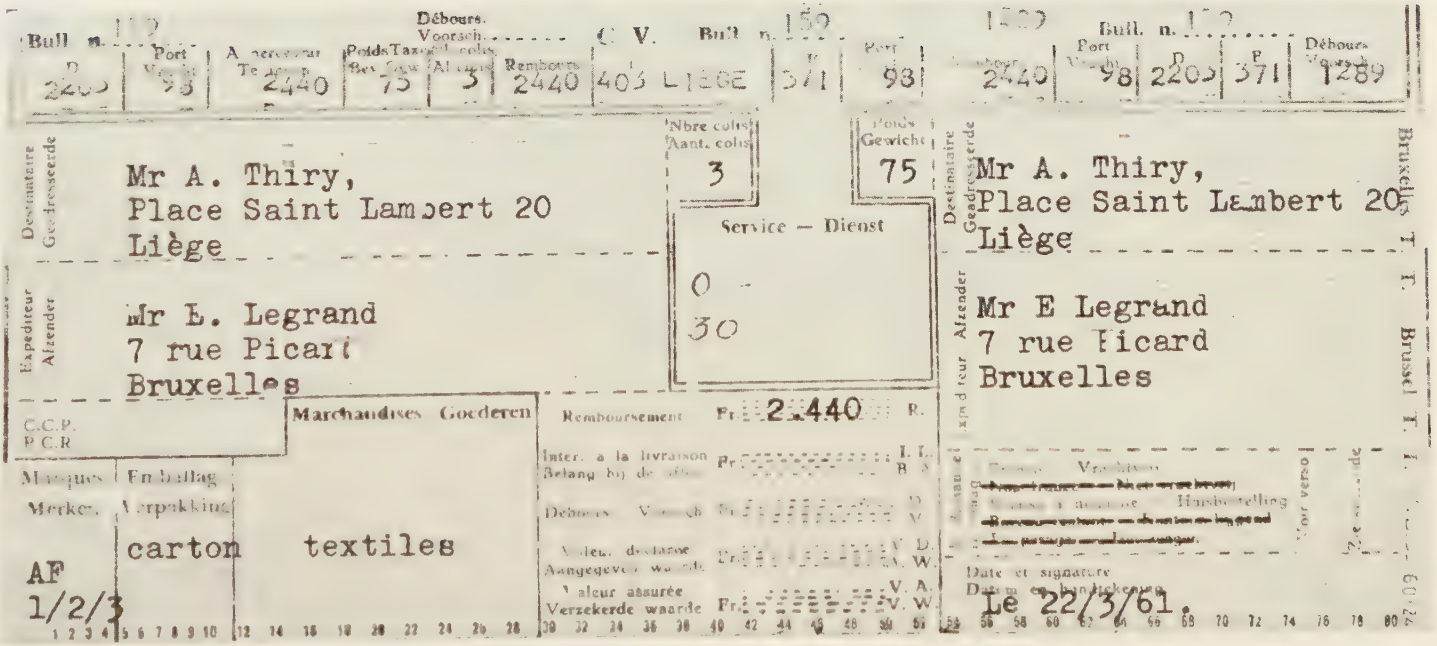

Bull n. 112
Débours
Port
Rembours
2440
Bull n. 152
C. V.
Port
93
2440
Bull. n. 112
Port
98
2202
371
Débours
1289
Destinataire
Mr A. Thiry,
Place Saint Lambert 20
Liège
Expéditeur
Mr E. Legrand
7 rue Picard
Bruxelles
Nbre colis
3
Poids
75
Service — Dienst
0
30
Marchandises Goederen
carton textiles
Remboursement
2.440
C.C.P.
P.C.R
Marques
Merken
AF
1/2/3
Emballage
Verpakking
Valeur assurée
Verzekerde waarde
Le 22/3/61.

Fig. 4.

D.C. 1957/Sp. LBX.

Ⓑ

Bruxelles (Tour et Taxis) — Brussel (Thurn en Taxis)
TEL. : 18.60.50 — Post. : 1.722

Circul. n° 60 FD — Direction E
Omz. n' 60 FD — Directie E
11-12, 30.7.1953.

BORDEREAU DES ENVOIS PRIS A DOMICILE
BORDEREL VAN AFGEHAALDE ZENDINGEN

Compte courant Lopende rekening: 5609

Journée du Dag van: 03.03

N° du dossier Bundel N°	Bull.	Code 1	Code 2	Nombre colis Aantal colli	Poids taxé Bevracht gewicht	Remboursement	PORT VRACHT
267	158	1	2	1	3		31
267	52	0	3	1	30		33
267	817	0	1	1	2		20
267	816	0	1	1	2		20
267	51	0	3	1	6		27
267	50	0	3	1	7		30
267	812	0	1	1	4		20
267	49	0	3	4	280		213
267	815	0	1	1	2		20
			PAD	15	Total du jour		429
			ATH		Totaal van de dag		

Code 1

- Franco remise à domicile / Vrachtvrij huisbestelling: 0
- Franco Bureau restant / Vrachtvrij Kantoorligg.: 1
- Non franco remise à domicile / Niet vrachtvrij huisbestelling: 2*
- Non franco Bureau restant / Niet vrachtvrij Kantoorliggend: 3*

Code 2

- Colis postal / Postcollo: 1
- Express: 2
- Grande vitesse / IJlgoed: 3

* Non compris dans le total
* Niet in het totaal begrepen

Fig. 5.

consisting of parts A and B which are still joined together.

10. *Consignment statement (D.C. 1957).*

A statement of all his consignments of the day is made on the tabulator for each consignor (fig. 5).

The data characterising the consignment, the amount collected for repayment and the carriage charges are shown for each consignment. The delivery charges not included in the transport charges (postal and express parcels) are given in full and the whole of the charges added up. The total for the day is put on his account if the client has a current account at the station, or collected the following day by the lorry driver if he has no account.

For purposes of verification, the total charges on the statements for a given series (farde) must correspond to the total calculated by the Gamma and perforated on the « results » card. As soon as these statements have been got out, the grouping of the cards by series (farde) no longer serves any purpose.

11. *Sorting.*

The cards are sorted according to the method of consignment « carriage paid » or « carriage forward ». Each of these two groups is then sorted per destination road centre, and in the case of the ones sent carriage forward to await arrival, per destination station.

12. *Consignment statement D.C. 1897.*

Two consignment statements are prepared for each wagon leaving (fig. 6) for the destination road centres. One lists the carriage paid consignments, the other those sent carriage forward

This statement enables the arrival station to identify a consignment when neither the parcel nor the card have reached it. It also facilitates investigations should a parcel arrive without a card.

In the case of « carriage forward » consignments, a copy of the statement is sent to the Receipts Control Department. It enables this department to make sure that the charges due have been collected by the arrival station.

13. *Stamping.*

A distinctive mark with the words « carriage paid » and the date is stamped on every card for a carriage paid consignment. Only the date is stamped on cards for « carriage forward » consignments.

14. *Verifications at the end of the journey.*

Agreement between the total amount of charges calculated and the total amount due according to the D.C. 1957 statement on the one hand, the number of consignments dealt with as « carriage paid » by the Gamma and the number of cards stamped « carriage paid » by the stamper on the other hand, is checked before sending on the documents.

15. *Delivery.*

Grouped according to destination, the cards are sent to the delivery service at the same time as the D.C. 1897 statements. These documents are sent to the

Lot	Dat.	Gare destinataire / Bestemmingsstation	Codes : 1		
362	1712	CHARLEROI		Franco R. A. D.	0
				Franco B. R.	1
				N. F. R. A. D.	2
				N. F. B. R.	3

2 1 C.P. 2 XP. 3 G.V.

Brussel-T.T.
Bruxelles-T.T.

Lot	Dat.
362	1712

No bull.	No - Nr Fact.	Rembour-sement	PORT VRACHT	Code 2	Code 1	OBSERVATIONS OPMERKINGEN
520	129	00612	0035	1	0	! 1
520	129		20	1	0	
741	137	310	29	1	0	
497	199		47	2	0	
241	101		20	1	0	
241	101		20	1	0	
241	101	612	35	1	0	
521	138		20	1	0	
223	164	310	33	1	0	
223	164		20	1	0	
241	102		20	1	0	
223	164		20	1	0	
521	138		20	1	0	
437	157	612	35	1	0	
741	136	612	35	1	0	
520	129		20	1	0	
223	164		20	1	0	
437	157		20	1	0	
520	129		20	1	0	
			00489			

Bull.	Nombre colis Aantal colli
520	001
520	1
741	1
497	1
241	1
241	1
241	1
521	1
223	1
223	1
241	1
223	1
521	1
437	1
741	1
520	1
223	1
437	1
520	1
	00190019 00055

D.C. 1897/Sp. LBX. Bruxelles (Tour et Taxis) – Brussel (Thurn en Taxis) Avis 45 C de mai 1954. Bericht 45 C van Mei 1954.

Fig. 6.

road centres either by the connecting trains, or even, more quickly, by passenger trains.

16. *Accountancy work in the case of current accounts.*

When making out the D.C. 1957 statements, a summarising card records the amount of the charges with which each account is to be debited.

After a period of 10 days, a summary of the charges for the period is got out on the tabulator for the client. This is posted to him in the form of an invoice with a request for payment.

A copy of these statements is sent to the department responsible for keeping the current accounts.

17. *Operations on arrival.*

The destination road centre receives parts A and B still attached together. These are handed to the lorry driver making delivery, after a record has been made of the sums to be collected. The lorry driver obtains receipt from the consignee, tears off part A and hands this to him with the goods.

In the case of consignments sent to await collection, the card is sent to the station in question, which carries out the same operations when the client turns up.

Parts B are retained by the road centre or destination station.

The D.C. 1897 for consignments sent « carriage forward » is sent to the Receipts Control Department after the charges due have been collected.

C. **Cadence of the work.**

The number of documents to be dealt with mechanographically each day varies considerably. The generalisation of the five day week means that there is a regular peak on Fridays and very little traffic on Saturdays. The traffic itself varies according to the time of year and always increases as the main holidays approach.

The average number of documents dealt with amounts to 13 164 a day (except on Saturdays) and at peak periods more than 16 000 have been recorded on certain days.

The equipment has been designed so as to be able to deal completely with 5 000 documents an hour, but the cadence in practice does not exceed 4 500 documents. This cadence is essential if the work is to be fully completed before the departure of the first train connections.

The electronic computer is normally plugged in about 4.30 p.m. and completes its work between 8 p.m. and 8.30 p.m. according to the number of consignments there were that day.

The codification and perforation of the cards begins between 2 p.m. and 4 p.m., in order to assure that the machines will be working continuously. Between 8 p.m. and 10 p.m., sorting takes place and the preparation of the D.C. 1957 and 1897, and the stamping of the documents.

During the morning, one operator carries out the perforating of the cards to be issued to clients and prepares the orders.

It will at once be appreciated that the

cadence of 4 500 documents an hour, although essential, is far from being fully utilised during the normal working day of 8 hours. In fact, it may be considered that under present circumstances, the equipment is only fully utilised for preparing transport documents for some 40 to 50 % of the period, according to the amount of traffic that day.

D. **Staff.**

The running of the mechanographical centre has been entrusted to a station agent. He was sufficiently intelligent to become familiar very quickly with the methods used in mechanography. In addition, he had a thorough knowledge of all the station departments. This knowlegde has been found to be invaluable in making full use of the new method of working. His training into mechanography as well as that of all the staff employed at the centre was given by the firm « Bull ».

Under his orders there are :

— 1 chief operator;

— 6 operators;

— 13 perforators.

These employees are railway-clerks and their number has been calculated so as to be in a position to work at a cadence of 4 500 documents an hour.

Codifcation is done by some of the perforators until 4 p.m. and then carried on by relief staff taken off other station duties for a few hours.

The codification of 1 000 cards takes approximately 1 hour 40 minutes work.

E. **Financial results** (1).

Although the objective aimed at in installing mechanographical equipment was essentially to improve the regularity of the work, the financial results of the operation were not overlooked.

A balance sheet got out during the study showed an estimated saving of 700 000 francs a year in favour of mechanographical work.

The results of the first years working confirmed these estimates.

The cost of mechanography during this year may be broken down as follows :

a)	hire of the machines	3 262 621 fr.
b)	labour costs	1 914 884 fr.
c)	sinking fund charges for installation	323 766 fr.
d)	sinking fund charges for cost of installation and preliminary trials	325 875 fr.
e)	various expenditure	280 000 fr.
		6 107 146 fr.

The cost of the work calculated as a function of the actual traffic and the output obtained before the installation of mechanographical equipment, would amount to approximately 6 750 000 fr. a year were there a return to manual work.

The balance sheet for the first year thus showed a saving of about 650 000 francs, i.e. 9,6 % of the previous expenditure.

As an indication, the number of

(1) The figures are given in Belgian francs.

documents dealt with by the mechanographical equipment amounted to 3 262 253 during this first period. Dealing with the documents therefore cost 1.87 fr. a piece.

F. **Regularity of functioning.**

All mechanical or electrical equipment is subject to break down. Mechanographical equipment is no exception to this rule, in spite of the many precautions taken by the supplier to assure impeccable maintenance.

A break down is not of any serious consequence when it occurs on the classic type of machine. These machines are in duplicate and the damage is quickly discovered and repaired by the firm's special expert on the job.

But it is quite otherwise when the damage occurs in the electronic unit. It cannot be said to happen very often, but it has happened several times during the first year.

The work can not be put off until the next day, so an agreement was made with the supplier. This agreement authorises the station, if the apparatus cannot be repaired very quickly, to send the documents for the day to the headquarters of Messrs. Bull, where they are dealt with by similar equipment to that installed at the station. This method of acting naturally involves a little delay, but does make it possible to complete the work the same day.

Any break-down of the equipment has always been dealt with to permit to start work again early on the following day.

G. **Advantages of the mechanographical method.**

Apart from a much more assured regularity of working, the mechanographical method has given other advantages which are far from negligible.

1. It gives an absolute guarantee of accuracy in calculating the transport charges and other costs. Subsequent adjustment of the charges, which clients never like, have been practically eliminated.

2. It makes it possible to give clients clearer and better presented documents. Certain important clients have greatly appreciated this advantage.

3. It makes it possible to get out accurate traffic statistics, and in certain cases adapt the composition of the train better to the actual traffic requirements.

4. It eliminates the enormous amount of space needed at departure stations to file copies of the transport documents. Microfilming makes it possible to keep copies of the documents in a very small space. In case of ligitation, it is much easier to find the necessary documents.

5. The ease with which mechanographical methods make it possible to meet peak traffic must be stressed.

The periods of heavy traffic as well as the tendency for the traffic to be concentrated into the first 5 days of the week have led to peak traffics quite unknown in former times, exceeding 16 000 documents a day in internal service. It would not have been possible to deal by hand with such numbers under satisfactory conditions.

Future projects.

Since putting the equipment into service, we intend to complete the use of these machines by mechanising other work at Brussels (T.T.) station.

The difficulty, however, lies in the fact that most of the work can only be done at the end of the day, precisely at the time when the equipment is working at full capacity dealing with transport documents.

Certain results have however been obtained. We might mention in particular the getting out of commercial statistics for the station, as well as the daily accounting of the charges to be collected by the lorry drivers when delivering parcels on which customs dues have to be collected.

A more complete study is in hand in order to mechanise completely the accounts of the customs department attached to the depot.

[625 .214 (44)]

Examination of trains in motion at the Pierrelatte station (Paris-Marseilles line),

by M. GARIBALDI,

Engineer, Head of the Carriage and Wagon Subdivision of the Mediterranean Region of the S.N.C.F.

(*Revue Générale des Chemins de fer*, February, 1961.)

FOREWORD.

Regularity of circulation is an important safety factor... In addition, it is an obligation that any transport undertaking must have towards the public (1).

Safety and regularity of transport requires careful attention to the condition of maintenance of the rolling stock (2).

These two essentials : *regularity* and *safety*, necessitate, at every level, vigilant controls, especially of the condition of the rolling stock. The inspection of the latter is, first of all, carried out when it is at a standstill by specialised staff (station examiners) before it leaves the making up and arrival stations.

In spite of the vigilance of this staff, safety may however be compromised during the run by accidental damage or the results of unexpected fatigue which, at a given moment, lead to either the breaking or defective working of some part. And when a train is forced to stop on the open line or at some other station than its proper stopping station, the regularity of running of the following trains is upset.

The problem reported in this article is the inspection of the goods trains, and more especially the *fast goods trains* (GV accelerated trains according to the Regulations concerning the use of wagons in international traffic : RIV).

(1) Extract from the General Instructions concerning controlling the regularity of running of the trains of the S.N.C.F.

(2) Extract from the Regulations concerning the inspection of rolling stock of the S.N.C.F.

Because of their nature and the diversity of the stock of wagons, these trains are inspected as constantly as possible, with frequent stops involving long delays whilst they are at a standstill.

According to the S.N.C.F. regulations, this examination includes :

— safety inspections before leaving the marshalling yards;

— safety inspections during the run, which take place when the train is stopped, the first after not more than 100 km; the others every 200 to 250 km;

— thorough examination on arrival at destination;

— close supervision during the run by all the traffic staff and by specially appointed observers on certain lines, pointsmen, examiners, level crossing keepers, etc.

If inspection on departure or arrival and supervision during normal running from examination posts does not impede the flow of traffic in any way, it is quite otherwise in the case of safety inspections made during the run, the object of which is a rapid examination of the stock to discover any damage which might have started or developed since the last stopping station. In certain cases, this obligation may be very difficult to carry out, or may involve considerable cost, for example if there are not sufficient sidings at the appointed place according to the distance travelled, to take trains following each other in quick succession at intervals of a few minutes.

It was a difficulty of this sort with which the Mediterranean Region of the S.N.C.F. was faced in the case of the first examin-

ation stop to be set for the fast goods trains (RA) running between the new marshalling yard at Avignon-Champfleury and Chasse-sur-Rhône. The only possible stopping place would have been in the Portes-Valence area, but the distance between Valence and Avignon (125 km) was considered to be excessive, owing above all

PRELIMINARY STUDY ON HOT AXLEBOXES.

INFLUENCE ON THE SITE CHOSEN.

The objective aimed at being to replace inspection when stopped by inspection when

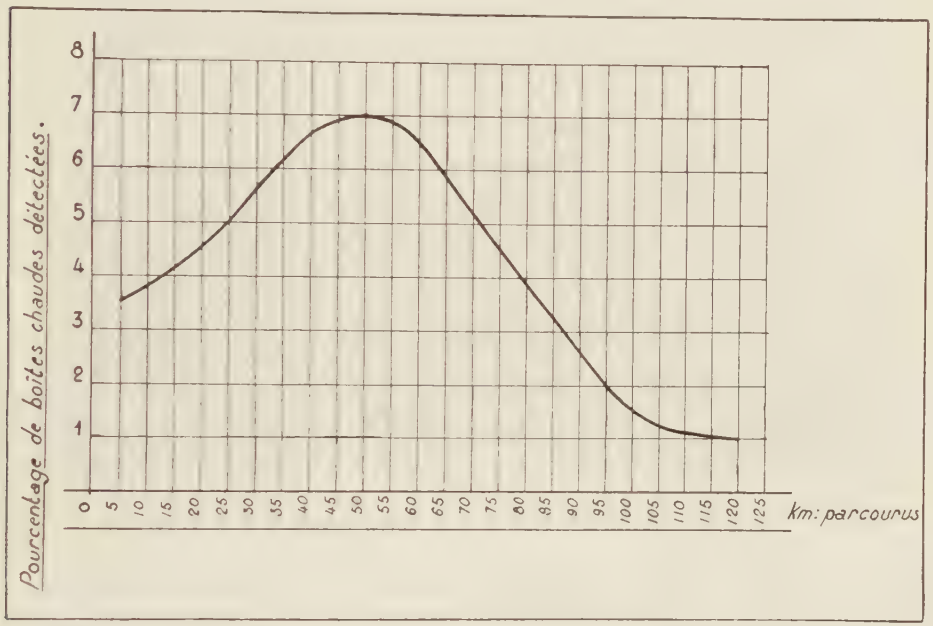


Fig. 1. — Distribution of hot boxes detected by examiners on electric goods trains over the line.

N. B. — Pourcentage de boites chaudes détectées = percentage of hot boxes detected. — km parcours = km run.

to the amount of « passenger » and « goods » traffic on this electrified line. For this reason, an endeavour was made to find a solution which would meet safety requirements without having to stop the trains.

This solution was to inspect the train *when it was moving past very slowly* by a specially trained employee (station examiner) at a specially designed inspection post. The site chosen was at the station of Pierrelatte, about half way between Avignon and Valence.

running past, i.e. without a stop, the examiner had to have improved facilities compared with an ordinary look out, and the site at which he works had to be chosen with care. Hot axle boxes are the most common of the serious types of incidents which occur, so that it was essential to study the Avignon-Valence run and the outward signs which might lead to their detection as the train ran past, sooner and better than an ordinary examiner could.

The preliminary study therefore covered two main points :

1) determination of the distribution of stops on the open line due to examiners having discovered a hot box on a goods train passing them at full speed over a 125 km long run, the distance corresponding to that between Avignon and Valence;

Fig. 2. — Installation used to study the heating of axle boxes.

2) analysis of the exterior signs, *other than the temperature,* showing that a box is hot from the time it starts until the journal breaks.

Figure 1 sums up the first part of the study covering several hundreds of hot boxes, and shows how reports of these were distributed over the run from the marshalling yard, by examiners on the line, excluding those discovered in the stopping stations. As far as we are concerned, these latter can be left out, as the inspection post to be run past is intended to inspect moving trains and only stop them if anything suspect is noticed.

The second point of the study was to discover the first signs of a hot box which would lead the observer to suspect something was wrong with a train running past him. Numerous tests were carried out, covering the two main hypotheses possible : shortage of lubricating oil, and the bearing displaced because of a shock. Figure 2 shows the installation used for the tests carried out for an axle load of 17 t, and a uniform speed of 60 km/h. The maximum duration of each test was 3 hours, corresponding to a run of 180 km.

The main facts noticed were the following :

a) the unit « oil-box-journal » which is cold and dry (without lubricating element), which has already heated up on the line, belonging to an axle under a vehicle running at a speed of about 20 km/h, makes a definite whistling noise which is easy to distinguish from other noises ;

b) during tests made at 60 km/h, with temperatures of between 80° and 100° C measured on the exterior of the side of the hot box opposite to the direction of running, there is a slight smoke. This smoke can be seen when the train is stopped or running slowly;

c) the smoke increases more and more

as the temperature rises. After 200°, it should not escape the notice of an alert observer looking at a train running at its normal speed;

d) still at 60 km/h, intermittent and barely perceptible whistling can be heard at low and at very high temperatures;

e) the breaking of the journal occurs when the outside temperature of the side of the box opposite to the direction of running is between 600° and 650°. The temperature of the journal immediately after breaking is then about 800°;

f) the distance run between the time when the outside temperature of the side of the hot box opposite to the direction of running has reached 80° or so (appearance of first signs of smoke) and that when it reaches 625° (breaking of the journal) varies between 27 and 80 km. The rapidity with which heating occurs depends upon the cause : for example, if the bearing is turned towards the front, at an angle of 45° (hypothesis of a violent shock) there is very rapid heating and the journal breaks after about 30 km. On the contrary, if the lubricating oil fails, heating takes place much more slower and breaking will only occur after 50 to 80 km, after there is no longer any lubrification (1);

g) for the temperature to rise from 100° to 200° on the exterior of the side of the hot box opposite to the direction of running, it takes about 10 minutes (10 km at 60 km/h). It is only after 200° that the smoke becomes sufficiently dense to be noticed by an examiner in the case of a train running at its normal speed. At low speeds, the first slight smoke which appears soon after 100° can be seen 10 km sooner.

Although only approximate — many other factors play their part in speeding up or slowing down the evolution of a hot box — the information collected during these preliminary studies made it seem likely that satisfactory results could be obtained from an inspection of the train in motion some 50 or 60 km from Avignon and so arranged as to allow small noises (whistles in particular) to be audible and

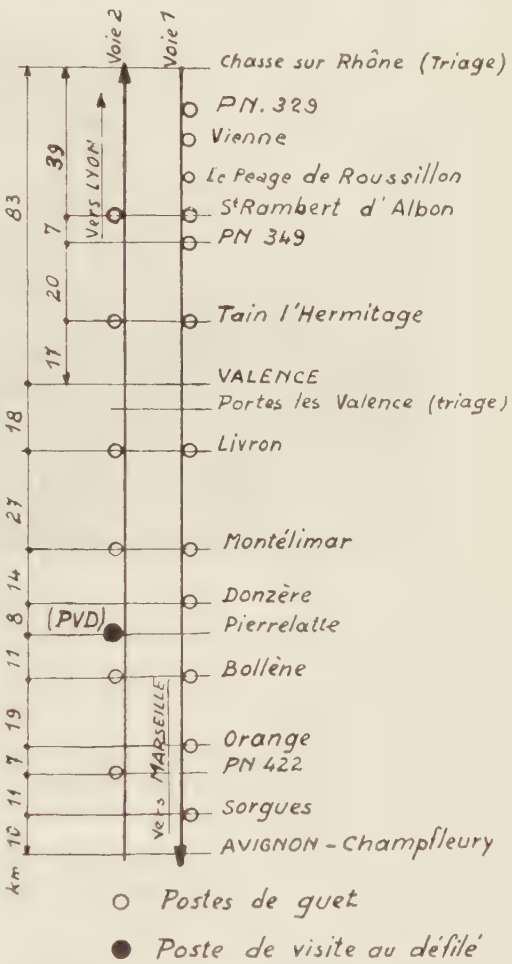


Fig. 3. — Arrangements for examining the trains between Avignon and Chasse.

N. B. — (Triage) = (marshalling yard). — Voie = track.

○ Examination posts.

● Posts where trains are inspected as they run slowly past.

(1) The reader should refer to the study: « Avoiding broken journals », by M. PATIN, in the « Revue Générale des Chemins de Fer », April 1957. Journals with bronze bearings, the subject of the test, broke at the 60th km after the film of oil was destroyed.

the slightest amount of smoke from hot boxes to be seen.

As for other damages, which are more numerous but often less serious, it would seem that these could be easily discovered if the train was made to run at reduced speed before a well placed observer who could thus see all the essential parts of the vehicles.

Figure 3 shows the position of the Pierrelatte station on the main Avignon-Chasse line, and that of the look out posts on either side of it.

It is, however, only the look out posts on the left side (V. 2) which offer sufficient guarantee, as those on the right side are often impeded by crossing trains (V. 1).

DESCRIPTION OF THE INSTALLATION.

The installation (fig. 4 and 5) has been designed to :

— allow a single employee to check during passing, no matter what the weather or the time of day, the essential parts of the wagons of a train whose speed has been reduced to 15 km/h (i.e. 4 m/s), from both the left and right hand sides;

— stop the train immediately if anything wrong is noted, or in the contrary case, allow it to resume its normal speed *without interrupting its running*;

— if necessary detach the wagon in question without delay.

Fig. 4. — General view of the inspection post for moving trains at Pierrelatte station. The shelter can be seen on the left and the mirrors on the right.

It includes (fig. 6) :

1. A shelter for the examiner.

The covered area is 2.50 m² and the roof projects in such a way as to protect him both from objects from passing trains, and sun and rain.

The floor of the shelter is 1.150 m below rail level, so that the examiner when seated

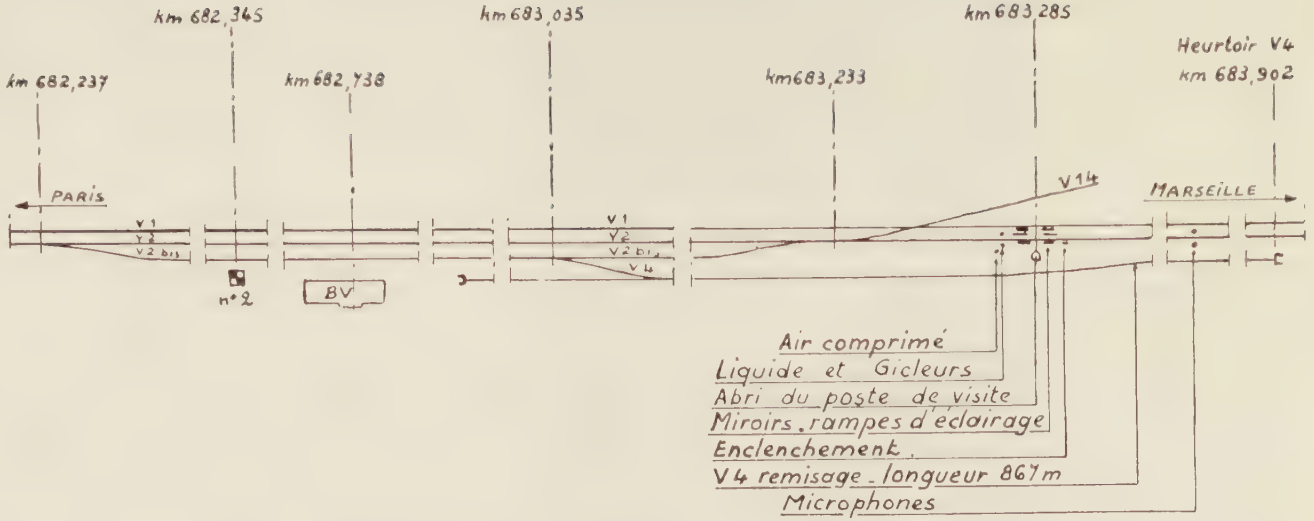


Fig. 5. — Diagram of the installation for inspecting moving trains.

Explanation of French wording :

Air comprimé = compressed air. — Liquide et gicleurs = liquid and nozzles. — Abri du poste de visite = inspection post shelter. — Miroirs, rampes d'éclairage = mirrors and lighting ramps. — Enclenchement = interlocking. — V 4 remisage, longueur 867 m = V 4 siding where defective wagons are taken off, 867 m long. — Heurtoir = buffer stop.

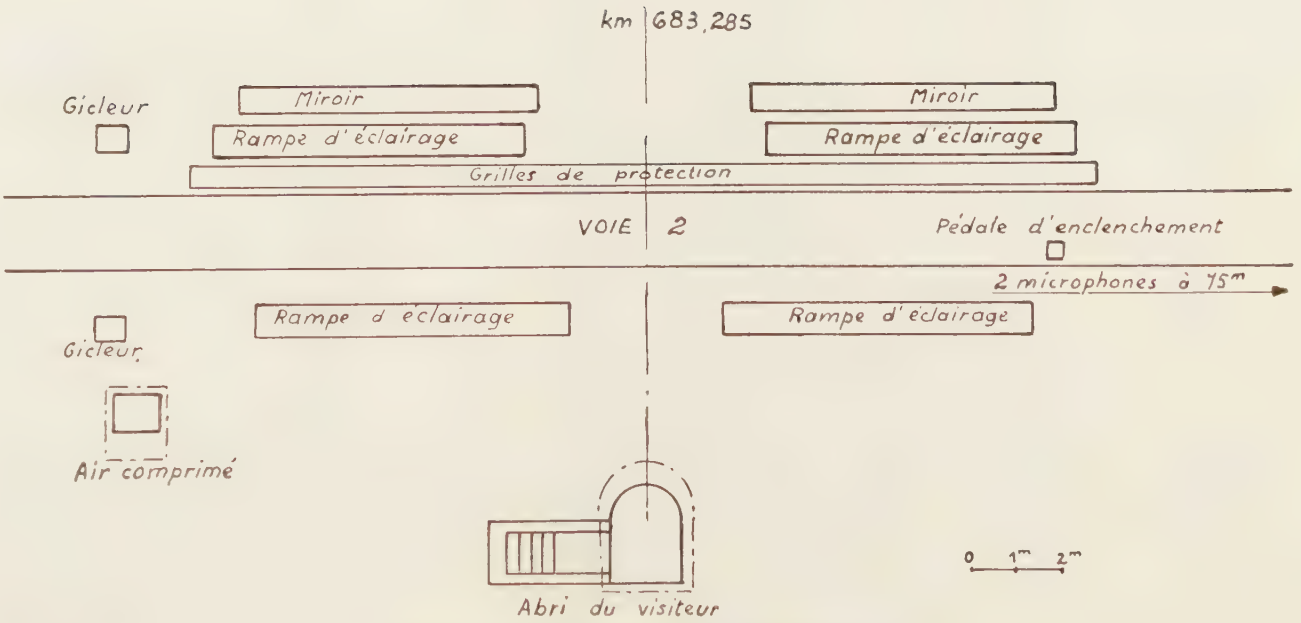


Fig. 6. — General plan of the inspection post.

Explanation of French wording :

Gicleur = nozzle. — Miroir = mirror. — Rampe d'éclairage = lighting ramp. — Grille de protection = protective grids. — Voie = track. — Pédale d'enclenchement = interlocking pedal. — Air comprimé = compressed air. — Abri du visiteur = examiner's shelter.

has the axle boxes at eye level and gets an excellent view of the parts under the frame.

Inside the shelter is the equipment for working the different devices described later on.

A table on which are the telephone and control buttons for rapidly working these devices completes the shelter, which is heated by an electric radiator.

sitting in the shelter, can see in them the other side of the vehicles running past him.

The mirrors are surrounded by protective sheeting; this protects them mainly from objects thrown out by passengers and against rain. A hot air device, operated from the shelter, keeps them from freezing over and drys them off rapidly, essential in winter.

Fig. 7. — View showing the mirrors and lighting ramps. (Train side opposite the examiner.) In the lower part of the picture can be seen the defrosting ramps using hot air.

2. Mirrors for examining the side opposite the shelter (fig. 7).

Two such mirrors have been installed between tracks : 1 and 2 on either side of the centre line of the shelter. These mirrors, which are 6 m long and 0.66 m high (1) are mounted in an adjustable frame moving around a horizontal axis parallel to the track. They are slightly inclined from the vertical, and their position is adjusted so that the examiner,

(1) This height was subsequently increased to 0.900 m in order to increase the area of vision on the far side.

3. Lighting ramps for night inspection.

There are four such ramps. They are sited two by two more or less in front of the mirrors, on either side of Track 2. Their position is slightly staggered compared with the mirrors, to assist observation. Their form has been designed to project rays of light without dazzling the observer.

There are five 200 W lamps under port holes in these ramps. The base of the ramp which is of white enamelled sheet forms the projector. The lighting ramps are covered by a metal grid to protect the lamps and allow people to walk over them.

The lamps can be lit or extinguished either :

— manually by the examiner:

— automatically by the train to be inspected.

The automatic lighting up of the ramps is assured by a pedal of the type used to announce the trains at level crossings. This pedal, which is worked by the first axle of the locomotive, comes back to the stop position at the set interval after the last axle has passed, thus extinguishing the lights.

This device consists of :

— two microphones fitted in cases mounted on supports on either side of Track 2, 75 m before the shelter, the active cell of the microphone being at the height of the boxes (fig. 8);

— an adjustable amplifier so that the intensity of the reception can be varied, and it can be adjusted as desired. The amplification of sharp notes and the deadening of deep notes makes it possible to bring out any whistling;

Fig. 8 — View to the right and left of the track showing the microphone cases placed at axle box level.

f. A sound transmitting installation.

Hot boxes or other parts which are rubbing against each other produce a characteristic whistling noise during running. So that the examiner can hear this whistling without being distracted by outside noises, a sound transmitting installation retransmits noises picked up at the level of the axle boxes into the shelter.

— a loud-speaker.

The amplifier is installed in the shelter, with the buttons for switching on and regulating it convenient to the hand of the examiner. The loud-speaker is fixed on the back wall behind him. It has been found that this device makes it possible to distinguish fairly easily the characteristic whistling due to a hot box, even before the first smoke appears.

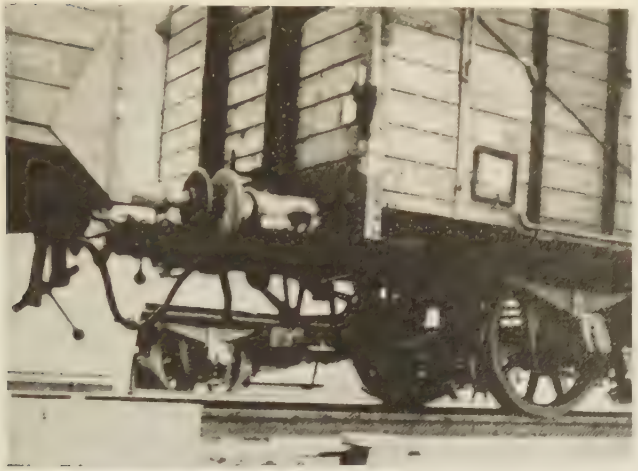


Fig. 9. — A train passing at a speed of 15 km/h by day

Fig. 10. — A train passing at a speed of 15 km/h by night

5. Rapid means of communication in order to reduce the time the trains being inspected take to pass or have to remain stationary.

a) A button reporting trains without damage by means of which the examiner signals to Pierrelatte station that the train he has just inspected can continue on its way.

This button controls from a distance a yellow signal, together with a warning bell sited in the office of the responsible officer who can then give the line clear signal more than a minute [illegible] before the locomotive arrives and the driver

can begin to pick up speed *without having to mark the stop.*

b) A telephone connects the examiner's shelter to the office of the responsible officer.

This makes it possible for the station to warn the examiner of the trains and for the latter to report to the responsible officer the reason why a train has to be stopped.

c) Marking equipment consisting ot two nozzles placed on either side of Track 2, ten metres after the shelter and one metre from the rail.

This installation consists of :

- a tank containing, under air pressure, the liquid used for marking;
- a set of two compressed air cylinders (1 working, 1 spare) with relief valve;
- an electrovalve operated by the examiner;
- nozzles designed to restrict the jet of liquid to the running gear without marking the bodies.

The nozzles are operated by a button close to the left hand of the examiner. He marks the suspect vehicle (or its immediate neighbour) without interrupting his inspection of the train : this makes it easy for him to recognise the vehicle in question. To speed his movements between the shelter and the station, 550 m away, the examiner uses a bicycle; he also has some tools and a few spare parts so that he can carry out minor repairs.

Fig. 11. — After being examined as it moves past, the train runs onto track 2 *bis* where it will only stop if the examiner has discovered anything wrong.

ORGANISATION OF THE DETECTION SERVICE.

To understand what follows, will the reader please refer to fig. 5.

The trains to be inspected are show on the timesheets and come up to the inspection post at 15 km/h. They are sent on track 2 bis. The working principle of the inspection post is as follows.

First of all, the examiner « listens » to the running at a distance of the first part of the train, then he begins to inspect by sight the wagons running past him at 15 km/h on track 2, both on the left side in the direction of running of the train (direct view) and on the right side (as seen in the mirrors). The train then runs onto track 2 bis, the home signal for which

giving access to track 2 is *at danger*. At night, the lighting ramps light up as soon as the first locomotive axle passes over the interlocking pedal (fig. 9 and 10).

When the last vehicle has passed before him (fig. 11), if he has not noticed anything abnormal, the examiner presses the signal button for trains with no damage. This unlocks in the office of the Head of the Service the device which makes a signal appear and rings a bell to call attention to it. The Head of the Service then puts the signal to the line clear position. He then cancels the signal and stops the bell ringing.

If the examiner has noticed any damage which he thinks jeopardises safety or might do so, he marks the suspect vehicle as it passes and continues to inspect the train passing in front of him. As soon as the inspection is completed, he telephones to the Head of the Service and explains why the train has been stopped because the home signal remains at danger, and he repairs the damage if possible or has the train shunted on to the siding (track 4) so that the damaged vehicle can be taken off.

Special arrangements have been made for :

— cases where the examiner has to inspect a train arriving on track 2 immediately after the first train stopped on track 2 bis;

— repairing as quickly as possible any vehicles which have had to be taken off the train.

COMMENTS ON THE RESULTS OBTAINED.

The Pierrelatte inspection post which was put into service as a trial on the 4th October 1959, since the 16th March 1960 has been responsible for inspecting all the fast goods traffic between Avignon and Chasse-sur-Rhône. Temporarily, in order to check the effectiveness of the inspection, a stop was retained at Valence up to the 1st October 1960. During this stop, all the trains already inspected at Pierrelatte where again inspected whilst stopped, and the results compared with the observations made at Pierrelatte, Finally, all the trains are inspected once more when they stop at Chasse, where the greater number undergo thorough examination on arrival before being remade.

The bases of the fast goods traffic, progressively inspected during the trial year, are shown in the table appended.

Between Avignon and Chasse the fast traffic is characterised by :

— its rapidity : all the through trains run over this section of the line at an authorised speed of 100 km/h;

— the concentration of traffic during the night and the early hours of the morning ; during the winter, for example, 10 trains run in front of the inspection post between 21.00 h. and 6.00 h. and 6 trains between 7.00 h. and 8.00 hours, out of the total of 22 trains a day.

Periods	No. of units inspected		
	Trains	Wagons	millions (1) of t/km
— from 4th Oct. 1959 to 31st Dec. 1959	756	23 727	90.9
— from 1st Jan. 1960 to 31st March 1960 . . .	766	22 889	86.5
— from 1st April 1960 to 1st Oct. 1960	3 169	103 336	401.6
Total . . .	4 691	149 952	579.0

(1) This heading refers to the Avignon-Chasse run (308 km) or Avignon-Lyons (228 km) according to the trains.

Marseilles Avignon (starting point)		*Pierre-latte* (inspected in motion)		Valence (routine intermediate inspection point)		Chasse	Lyons
Track 2. Marseilles-Lyons	Observers		Observers		Observers		
Distance from station to station:	58 km		67 km		83 km	20 km	
Distance from starting station: 0		58 km		125 km		208 km	228 km
Underneath frame and frame :							
1. Hot axle boxes							
a) confirmed	1	10	1	8	1	4	1
b) suspected, not confirmed		(4)					
2. Brake damage							
a) brake still on	7	10	11	3	5		
b) damage to rigging		2		1		1	
3. Other serious damages : (broken, missing, or out of place parts)							
a) bottom of box loose or out of place		8		1		1	2
b) guard plate stay loose or out of place		6		1		7	1
c) guard plate broken		1				4	
d) back plate of suspension spring broken		5				9	1
e) suspension pins : missing		1					
out of place		1		3		17	2
f) spring hanger broken		1					
g) suspension spring buckle and spring gear broken or wedge missing				1		1	
Total A	8	45	12	18	6	44	7
Above frame :							
1. Cover, wagon sheet or trackle hanging down	2	6	1	2	3	5	3
2. Doors of high sided wagons or container open		4					
3. Rail-road trailer off its rails		2				2	
4. Loading needing adjustment or resecuring				3		2	
Total B	2	12	1	5	3	9	3
Total A+B	10	57	13	23	9	53	10

Fig. 12. — Statistics of the main damage endangering the traffic discovered between the 1th October 1959 and the 1st October 1960 on fast goods trains between Avignon and Chasse.

Fig. 12 gives on the above bases statistics of the results of the inspection carried out from the Pierrelatte inspection post compared with the other methods of inspection. All the damages shown in the table of fig. 12 are considered to endanger safe working. When discovered, it is necessary to stop the train immediately or at the next station, and the vehicle concerned is forbidden to continue its journey until the damage in question has been repaired.

The statistics call for certain comments :

a) *hot boxes.* — Out of 10 hot boxes confirmed, detected as the train ran past Pierrelatte inspection post, 6 were noticed by hearing the whistling from the damaged box before any smoke was visible on the outside. During the tests with fixed post previously reported (60 km/h), such whistling was barely perceptible and intermittent, and it is clear that though it is relatively easy to hear it at 15 km/h, it is in practice impossible to do so at 100 km/h. This fact is important and the value of this way of discovering the beginnings of heating in trains whilst running, provided the speed of the train has been much reduced, must be stressed.

Four other cases of heating were discovered by the classic emission of smoke. Figures 13, 14, and 15 show views of the damaged bearings : figures 13 and 14 show bearings removed from hot boxes revealed by hearing whistling without *any exterior smoke;* figure 15 shows a bearing taken from a hot box discovered because of smoke.

Fig. 16 compares the evolution of hot boxes detected as the train ran passed (Pierrelatte), when stopped (Valence and Chasse) and on the line by observers.

a) through hearing whistling without noticeable smoke; *b*) by seeing the smoke.

Fig. 13, 14 and 15. — Damaged bearings removed from hot boxes discovered at Pierrelatte :

b) *other damages.* — The Pierrelatte inspection post has been found invaluable for detecting the main damages endangering or upsetting the traffic. At the head of these come damages to the brakes which also upset regularity. The other accidental damage or fatigue noticed at Pierrelatte represent 75 % of the total damages detected at Pierrelatte and at Valence, 67 km further on.

c) *influence upon the traffic.* — An inspection when the train is passing at 15 km/h before an inspection post like that at Pierrelatte only takes 5 minutes, slowing down and getting up speed again included.

Place and method of detection	Number of hot boxes discovered		
	Serious (Axle journal seriously scored)	Average (Axle box journal scored)	Slight (White alloy beginning to melt)
PIERRELATTE km 58			
smoking	2	2	
whistling without smoke		1	5
PORTES or VALENCE km 125			
discovered by « touching »	3	2	3
CHASSE km 208			
discovered by « touching »		2	2
ON THE OPEN LINE			
by observers :			
BOLLENCE (1) (because they were smoking)	1		
MONTELIMAR (2)	1		
TAIN L'HERM (3)		1	

(1) : 11 km before Pierrelatte; (2) : 21 km after Pierrelatte; (3) : 18 km after Valence.

Fig. 16. — Classification of cases of hot axle boxes according to the degree of heating and the method of detection.

The minimum time required for routine examination of a stopped fast goods train of average composition is 16 minutes, of which 12 or 13 are available for the actual inspection which is carried out by two examiners. This time is not exceeded in the case of a train running on time by itself. But if the trains run on close after the other it often happens that this stop is the cause of serious delays, either because the inspection of the first train of the series took longer owing to its composition, which also delays the following trains, or because the traffic is running late which upsets the work of the examiners.

The saving in time when examination of a stopped train is replaced by inspection as it runs slowly past is 11 minutes at least and often more.

For even greater safety of the traffic, it is possible to have two such inspections between two stations 200 to 250 km apart, and the saving in time will still be at least 6 minutes. This latter solution has been adopted on the Avignon-Chasse or Lyons run owing to the general traffic density on this artery which has recently been electrified.

The dividing up of the Avignon-Chasse run has had a good effect on the safety of the traffic: only two stops have been needed for hot boxes outside the set stations where inspections take place (Pierrelatte and Valence) during the first nine months of 1960. During the first nine months of 1959, the number of stops for the same reason was 10 (fig. 17). From the point of view of regularity of running, Pierrelatte has discovered a great number of cases of damage to the brakes (brakes remaining on) which has reduced the number of subsequent interventions by the observers, and consequently unexpected stops. It should be noted that incidents of all kinds are more quickly dealt

1959				1960		
CHARACTERISTICS : *Steam* traction Trains starting from : Rognac 1st intermediate examination at Avignon 2nd routine intermediate examination at Portes or Valence 3rd routine intermediate examination or complete inspection on arrival at destination at Chasse				CHARACTERISTICS : *Electric* traction Trains starting from : Avignon 1st examination at 15 km/h from Pierrelatte inspection post 2nd intermediate examination at Portes or Valence (check) (1) 3rd intermediate examination or complete inspection on arrival at destination at Chasse (or Lyons)		
Place where hot box was discovered	Distance between stations where examination takes place	Number of hot boxes		Place of detection	Distance between stations where examination takes place	Number of hot boxes 1st Jan. to 30 Sept.
		Complete year	1st Jan. to 30 Sept.			
Examiners located before Avignon	94 km	3	1	Examiners located before Pierrelatte	58 km	1
Avignon		9	5	Pierrelatte		10
Examiners located between Avignon and Valence	125 km	12	10	Examiners located between Pierrelatte and Valence	67 km	1
Portes or Valence		10	7	Portes or Valence		7
				Examiners located between Valence and Chasse	83 km	1
				Chasse		4
Recapitulation :	219 km			Recapitulation :	208 km	
Hot boxes discovered on the line by examiners		15	11	Hot boxes detected on the line by observers		3
Hot boxes discovered in the examination stations		19	12	Hot boxes detected at examination stations		21

Note (1). — The second examination at Valence is normally carried out as at Pierrelatte whilst the train is mowing. It was to check the work done at Pierrelatte that trains were temporarily stopped up to the 30th September 1960.

Fig. 17. — Statistics for 1959/60 showing the distribution of hot axle boxes discovered at the inspection stations and along the line.

with at Pierrelatte than they could be in a station where there is no inspection service. Dealing with brake incidents for example takes on the average 8 minutes at Pierrelatte instead of the 20 involved when they have to be dealt with in a station because of the vigilance of an examiner.

Finally, the wagons which have to be

taken off at Pierrelatte are sent back to the station, repairs completed, within a very short time. The staff, the tools and the spares are sent by lorry from the maintenance depot at Avignon, which is the nearest, at the telephoned request of the Pierrelatte examiner.

During the trial year, the average delay in sending back to the station wagons taken off, repairs completed, was less then 10 hours, counting from the hour of arrival of the train. All the repairs in question were serious ones, such as the replacement of suspension springs or running gear (axles, bearings, etc...).

If the Maintenance Depot has no spares available (axles of foreign companies, for example), Pierrelatte is informed within the hour after the wagon has been taken off, and the load is then transhipped.

d) *effects upon working conditions for the examiners.* — From inside his shelter, heated in the winter, the examiner sees and hears the trains running past under excellent conditions. As he has not to bother about his own safety. he can give his whole attention to the job even during the night and no matter what the weather. If the trains run late, which greatly upsets inspections of stopped trains and thus reduces their efficiency very considerably, it does not matter in this case, as all the trains have to run at the same speed past the inspection post.

The use of an installation such as that of Pierrelatte requires certain training of the men using it, but experience has shown that they rapidly adapt themselves to the new methods. The technical material used has been kept very simple and convenient to use. If it facilitates the work of the examiner, it leaves him completely free to stop a train or not as he judges fit.

CONCLUSION.

Experience of the working of the inspection post for trains in motion at Pierrelatte dealing with fast goods trains has given complete satisfaction during the first year it has been in use.

Though the examiner no longer uses his sense of « touch », which he ordinarily makes use of in the stopping station to detect hot boxes, for example, or abnormally hot brake blocks, indicating that something is wrong with the working of the brakes, he has another element of appreciation from hearing whilstles and other abnormal noises.

The sense of touch may be restored to him by a device for detecting hot boxes by means of infra-red rays, when this technique has been finally perfected.

Whilst awaiting new progress in the rolling stock and the means of detecting damage *of all kinds,* the Pierrelatte post for the inspection of trains in motion is a very sure, simple, and cheap solution, suitable for situations where technical requirements forbid stopping and keeping trains stationary.

[625 .23]

Electrostatic influences affecting the dirt collecting propensities of passenger coaches,

by Prof. Dr.-Eng. H.F. Schwenkhagen, Wuppertal.

(*Glasers Annalen*, No. 10, October 1960.)

Some 350 years ago, Gilbert discovered the remarkable property of amber — the electron of the Greeks — of attracting light particles after it had been rubbed. His observations led to the theory of electricity and magnetism. But during the last hundred years, electrostatics have almost been forgotten, as physics and technical knowledge have taught us how to handle electric current and deal with far greater quantities of power than electrostatics could provide. The electrophorus and Leyden jar have joined the cake of resin and the fox's brush in the museum. The electroscope likewise, for measuring electrostatic phenomena, is now only used as a means of explaining fundamental phenomena in the high schools.

During the last decades, attention has once again been directed towards electrostatic problems on account of two facts: the increasing use of plastic materials with their great insulating qualities for the most diverse technical and domestic usages, has caused electrostatical effects to become very noticeable. At the same time, the perfecting of some modern apparatus, which would be easy to handle, and would measure without contact and without using any current, offered new possibilities for the study of the phenomena of charge and discharge. Whereas the gold foil electroscope only allows of qualitative indications and even modern electrometers only give quantitative indications at the cost of much time and trouble, the apparatus for measuring the

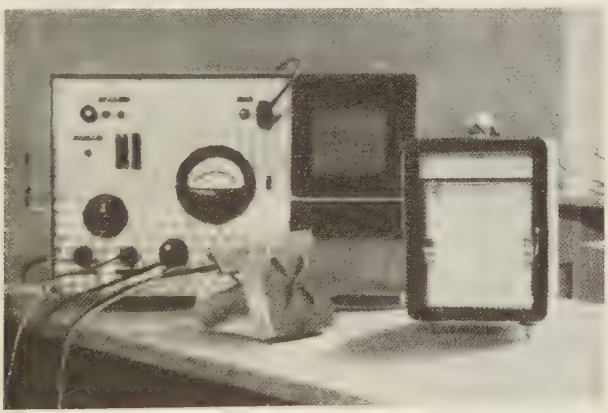


Fig. 1. — Apparatus for measuring the field intensity with recorder.

intensity of the field (fig. 1) used for the first time in 1925, allows of the measurement of the electric fields in a quantitatively accurate way without influencing them in any way. Its working is known from the articles written about it [1], [2] (*). We need only call attention to certain characteristic properties of the apparatus :

Simplicity of the extension of the field of measurement from 300 V/m to 3 MV/m;

Minimum incertainty in measuring (less than 2 %) together with simultaneous exact indication of the polarity;

The measurements are not falsified by the contact of surfaces under charge;

No electricity is taken from the field to be measured;

Possibility of recording the intensity of the given field by means of an ordinary ink recorder.

The knowledge acquired concerning the movement of charged particles in the atmospheric electric field, the knowledge of harmful effects this has owing to the dirtying of the walls of buildings and textile products, and its practical utilisation in the pulverisation of paints and the projection of particles on pieces of cloth, caused it to be suspected that electrostatic influences also played their part in the dirtying of passenger coaches. In particular, there was a tendency to attribute the strong adhesion of these layers of dirt to electrostatic influences. Previous measurements carried out with the assistance of apparatus for measuring the field intensity had shown the existence of space charges of different polarity in the neighbourhood of passenger trains, and these charges seemed to be due to the working of the locomotive.

Contrarily to what was generally expected, the paintwork of passenger coaches, even when old and very dirty, was found to be so insulating that it was possible to charge them electrostatically by rubbing, and they retained this charge for a considerable period. Trials showed that it was very improbable, in spite of the often expressed opinion, that the body of the coach as a whole should be considered as insulated from the earth while the trains were running.

Fig. 2. — Test coach.

1. Preliminary trials in the laboratory and preparation for taking measurements during running.

A comprehensive series of tests were carried out in the laboratory with trial blocks covered with different lacquer paints in order to measure on the one hand the charge capacity of the coat of paint, and

(*) The figures in brackets refer to the bibliography at the end of the article.

on the other, its conductance and dielectrical constant, in other words the electrical properties of the coats of paint. In the arguments between the paint specialist and the electrostatics specialist concerning the possible influence of the pigments on the charge capacity of the coats of paint, these tests showed that the electrical expert was in the right and his premises were correct, i.e. the pigments can only have a minimum effect, seeing that all the electrostatic influences are surface effects. The surface of the paintwork is however not conditioned by the pigment but solely by the binder as well as by the materials absorbed from the air. The tests show, in conformity with this point of view, that the very minimum « dirtying » of the surface of the paint by « Rei » is sufficient to change the sign of the surface charge. As tests using blocks exposed to bad weather systematically and controllable at will would have involved considerable cost owing to their long duration, it was decided after the tests already made, to carry out electrostatic measurements in a test coach whilst running.

The test coach (fig. 2) was adapted for this purpose. A converter group was installed inside to supply 50 cycles A.C. with a distribution circuit for the connection of the high tension rectifiers and the apparatus for measuring the field intensity. On each side of the coach, two windows were replaced, at the suggestion of the Laboratory of the « Technische Akademie Bergisch Land », by insulating sheets of pressboard in which the measuring electrodes were fitted. The measurement window with 24 panels (fig. 3) made it possible to use these panels with no charge or with a positive or a negative charge, arranged in check pattern, in order to determine the possible influence of a preliminary continuous voltage on the dirt. As the high tension rectifier can supply a sufficient amount of current to keep up the voltage, such panels do not require greater insulation than that which is already assured by the pressboard support.

Fig. 3. — Twenty-four compartment test panel, without magnets.

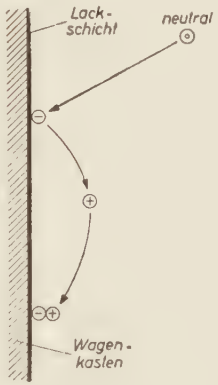


Fig. 4. — Phenomenon of electrification on the surface of the paint.

N. B. — Neutral = neutral. — Lackschicht = coat of paint (enamel) — Wagenkasten = body of the coach.

The three panel measurement window which can also clearly be seen on one side of the coach (fig. 2) is intended on the contrary to be used for determining the space charge in the neighbourhood of the train and to determine the possible deposition of space charges from an aerosol as the train passes (by aerosol is to be understood the colloidal dispersion of solid or liquid substances in the air). These panels supply very little current, so that care has to be

taken to see that the insulation is really effective. These measuring panels were therefore strongly insulated again from the sheet of pressboard by means of ceramic insulators with sheets of « trolitul » under them. This form of insulation was perfectly satisfactory during several days whilst the coach was standing at Vohwinkel before starting to take measurements during running. The time constant of the phenomenon of discharge for a measuring panel once it had been charged was of the order of more than

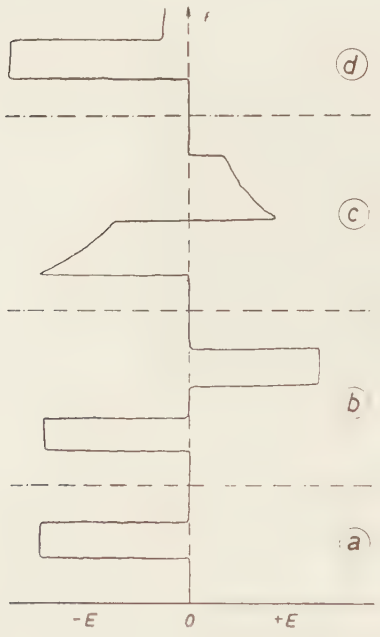


Fig. 5. — Electrification phenomena on a test model with double plate with artificial imitation of an aerosol cloud by means of a rubbed « trolitul » bar.

one hour. The antilogous panels fitted in the corridor or compartment of the test coach for the apparatus for measuring the intensity of the field made it possible, with such an insulation, to record the exterior space charges due to phenomena of influence, as well moreover, as determining accurately the raising of the charge of the system by deposits of charged aerosols, or by the collection of the charge from solid particles coming up against the panel as a result of the air currents. Fig. 4 is a diagram showing the fundamental principle of the two electrostatic phenomena between the aerosol and the surface of the paint. A neutral particle on striking the surface can become charged; this means that a charge of the opposite sign is left on the surface provided the coat of paint is sufficiently insulated. On the other hand, a separate particle of this sort as it moves along may as a result of the influence of the body of the coach undergo a further change of sign which will make it adhere to the body when it hits it again as a result of the electrostatical attraction. A phenomenon of this kind has nothing to do with the influence and can also occur when the surface of a well insulated coat of paint remains charged with electricity of the appropriate sign as a result of previous electrification phenomenon. Fig. 5 shows the records made during a test carried out in the laboratory with a model of the double plates used for taking the measurements.

In part « *a* » (fig. 5) the passage of the aerosol has been imitated by suddenly bringing up a bar of « trolitul » with strong insulating properties which has previously been rubbed. If it is a question of a cloud of aerosols, the same phenomenon does not give a rectangular recording but has a roun-

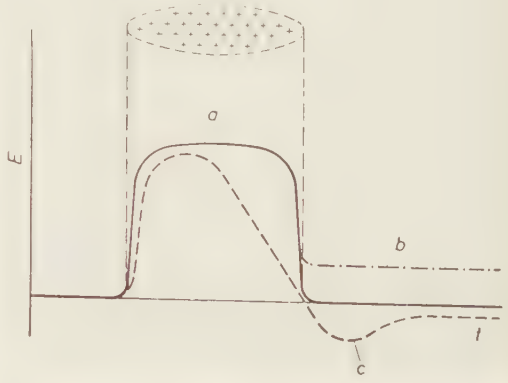


Fig. 6. — Variation in the field intensity for an exterior space charge.

TABLE 1. — **Programme of measuring runs.**

Date	Train No.	Traction	From ... to	Position on the train
9-9-1958	E 731	03	Wuppertal ... Hamm	behind the locomotive
		03 41	Hamm ... Rheine	behind the locomotive
		03	Rheine ... Emden West	behind the locomotive
		50	Emden West ... Norddeich	behind the locomotive
10-9-1958	D 48	03	Norddeich ... Munster	at the end of the train
		41	Munster ... Cologne	behind the locomotive
		03	Cologne ... Wiesbaden	behind the locomotive
		3810	Wiesbaden ... Francfort	at the end of the train
		E 18	Francfort ... Wurzbourg	3rd coach after the loc.
11-9-1958	D 48	01	Wurzbourg ... Munich	3rd coach after the loc.
12-9-1958	D 503	E 10	Munich ... Stuttgart	2nd coach after the loc.
		E 10	Stuttgart ... Mannheim	at the end of the train
		03	Mannheim ... Wiesbaden	behind the locomotive
		V 200	Wiesbaden ... Wuppertal	at the end of the train

ded form as a function of the variation in the density of the aerosol, as can be seen from the curve « *a* » of figure 6 which is a rough diagram.

In part « *b* » of figure 5, the charge is conducted towards the earth during the phenomenon of influence. When the conduction ceases, and that charge of influence is then annulled, there is a sudden change of sign on the system.

In the part « *c* » of the record (fig. 5); the omhic resistance of the earthing of the system has been artificially increased. As a result, the record no longer ends instantaneously, as in part « *b* », but with an exponential damping out. After the charge of influence has been eliminated, a charge of inverse polarity at once appears, which in its turn also decreases according to an exponential curve. If the same phenonemon were caused by a cloud of aerosols of irregular form, instead of by a concentrated charge we should get the form of curve « *c* » in figure 6. In part « *d* » of figure 5, a part of the charge of carrier exerting the influence has been transmitted to the exterior measuring panel. After removal of the charge of influence, there remains a residual charge

of the same sign on the system. This also would not follow this ideal path if these residual charges came from the aerosol, and would be influenced as shown in curve « *b* »

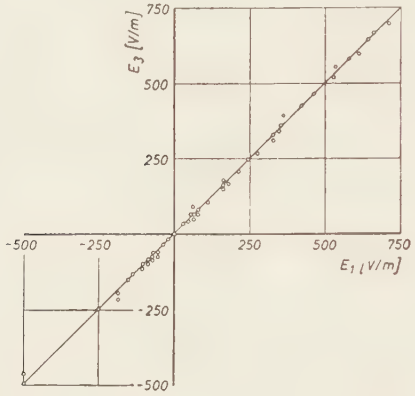
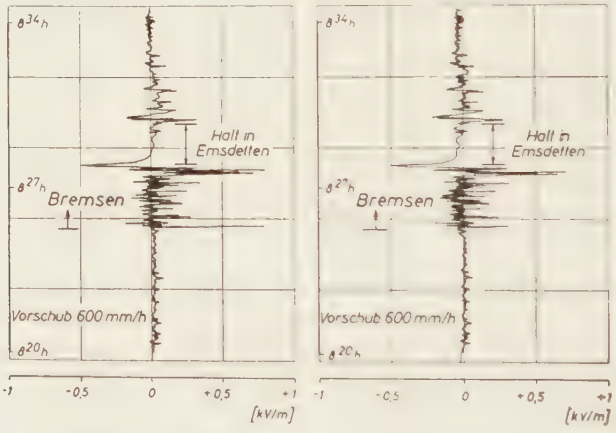


Fig. 7. — Correlation of the field intensities on the same side of the coach.

2. Measurements made whilst running and their results.

The measurements whilst running were made from the 9th to the 12th September 1958 on the Wuppertal-Munster-Norddeich-Munster - Recklinghausen - Cologne - Frankfort -Wurzbourg - Munich - Stuttgart - Mannheim -Wiesbaden - Cologne -Wuppertal line. During these tests, the measuring coach was included in the regular E 731, D 48 and D 503 trains. As it was running in regular trains, the coach was coupled up in different parts of the train and behind different kinds of locomotives (See table 1). The first part of the test had already given at least some interesting results, although not always easy to interpret physically. Figure 7 shows a correlation of the field intensities measured simultaneously on panels 1 and 3, in other words on the two outer panels of the measurement panel on a corridor wall. The uniformity of the records shown in figure 8,



Measuring compartment 1 (corridor). Measuring compartment 3 (corridor).

Fig. 8. — Braking with steam traction. Test coach behind locomotive. Wuppertal-Norddeich run, 9th September 1958, train E 731. Stop at Emsdetten.

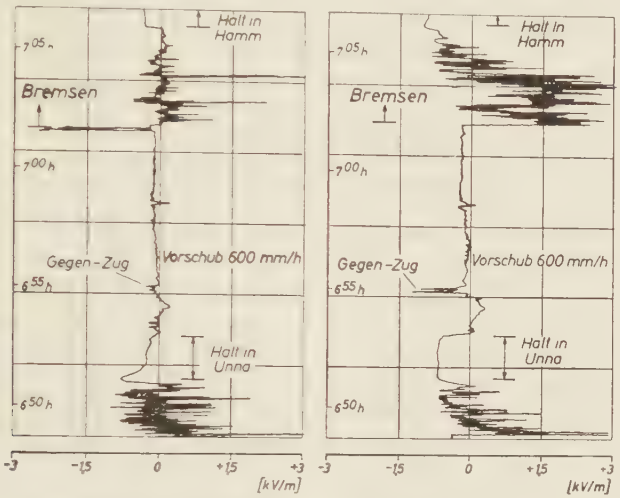
N. B. — Vorschub = advance. — Bremsen = braking. — Halt in Emsdetten = stop at Emsdetten.

of figure 6. A loss in the electrical mass would show itself as a progressive reduction in the charge.

which was constantly confirmed in control tests, already makes it possible to see a definite correlation, as figure 7 shows, although

the phenomenon as a whole is subjected to extraordinary variations in time. To a majority of positive fields there corresponds a smaller number of negative fields. The fields are not exaggeratedly high, but they are much stronger than was expected. If these fields must be attributed to a total charge of the body of the coach in relation to the earth, there should have been the same correlation in the recording of the fields on the measuring panels 1 and 6, which are identical but on opposite walls of the coach (fig. 9). A simple examination shows, however, that there is no such correlation; the analysis in the diagram of correlation of figure 10 confirms this. It can be concluded with certainty that these fields do not represent a charge of the coach body, but a record of the aerosols which are run through, which hit up against the two sides of the body in a very different fashion, and sometimes even with a different sign. The body of the coach must therefore be considered as constantly earthed in the electrical sense.

Figure 9 however allows of still other certain conclusions. The fields are weak in the neighbourhood of the coach over the greater part of the run. Considerable fields are found, however, when :



Measuring compartment 1 (corridor). Measuring compartment 6 (compartment).

Fig. 9. — Same measuring run as figure 8. Stop at Unna and at Hamm.

N. B. — Halt in Unna = stop at Unna. — Gegen-Zug = train passing each other. — Bremsen = braking.

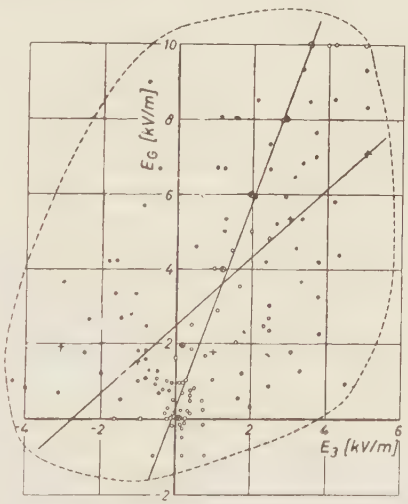


Fig. 10. — Correlation of the field intensities on different sides of the coach.

a) braking occurs;

b) when trains pass each other;

c) at certain given points on the line.

Braking phenomena produce the greatest fields, which are most often positive, though occasionally there is an inversion of the sign of the field which becomes negative. The preliminary braking and the main braking are definitely separated from each other on the section before the entry to Unna, which has also been confirmed in the case of other trains entering this section, although the preliminary braking and the main braking are not always so clearly separated in the traction of the trains. The greater part of the fields is produced by the preliminary braking. The phenomenon is practically terminated with the complete stopping of the train. It is therefore logical to consider as carriers of the electrical masses causing these fields the abrasive dust from the brake blocks drawn into the current of air behind the locomotive. But this does not explain the occasional formation of negative fields of a smaller though still quite appreciable value, of very short duration. These cannot be caused by the dust from the brake blocks which during laboratory tests were found in general to be positive in charge. It would appear more probable that these negative masses come from the steam of the locomotive, which nearly always has a negative charge. But during braking the regulator of a steam locomotive is nearly always closed, and the escape of any steam is therefore unlikely. It would appear more likely that these carriers of a negative charge are produced by the escape of compressed air from the brake gear, probably taking with it condensation water pulverised in this way. The absence of any communication between the measuring coach and the locomotive made it impossible to carry out any detailed research into the causes during running.

In second place, after braking operations, comes the passing of other passenger trains, as for example on the line between Unna and Hamm. The first surprise was that the field was more strongly felt on measuring panel 6 which is on the outside, in other words opposite the side where the train is passing. Measuring panel 1 clearly showed a similar phenomenon but nearly 10 times weaker. If it was a question of the dust on the track being whirled up as the train passed, one would have expected the main influence of this to be felt on the side near the passing train. But above all, a positive field was expected. The presence of a negative field can only be explained here if steam is the electrified carrier.

The locomotive of the passing train gives off a cloud of steam on the opposite side to the wind, i.e. here also on the side under the wind of the measuring train, in a region which is practically unaffected by the cloud of steam of its own locomotive.

Small charges, either positive or negative, as for example shortly before Hamm, are of little importance. The observers had the impression that these phenomena occurred when crossing bridges over or under the line, or when passing buildings very close to the line, or similar points. The fact that their sign is positive leads one to think that it is a question of the whirling up of the brake dust from the track occasioned by the dynamic effect of the air current about the train when the space is restricted.

Though such conclusions cannot be logically supported and are more like working hypotheses, this is still more so in the case of observations concerning the intensity of the fields during different brakings, as shown in figure 11 with its maximum values for the two forms of electricity, for the Wuppertal-Norddeich measuring section. To appreciate the variation of the whole as a function of the time, it must be remembered that on entering Munster, there was a slight mist. In spite of the precautions taken, this mist had a definitely harmful effect upon the insulation as was shown by a check made immediately after leaving Munster. Beyond this station, the time constant of the measuring device fell to an amount of less than one second. A longer lasting influence by running through aerosols was therefore no longer possible, although the possibility of the qualitative measurement of these aerosols was not reduced. The insulation did not appreciably improve during the brief interrup-

Fig. 11. — Maximum field intensities on braking, steam traction, measuring panel 1, Wuppertal-Norddeich measuring run, as figure 8.

N. B. — Sprühregen = mist.

tions in the rain. The reduction in the maximum field intensities measured between Wuppertal and Norddeich must therefore be attributed to the deterioration in the insulation of the measuring equipment. However, those taking part in the measuring had the subjective impression that the intensity of the fields set up during braking was

reduced, if not continuously, at least quite definitely by a maximum amount during the first braking, to lower values and tended to become small. But the results of the measurements obtained so far have not given sufficient justification for the expected correlation with the abrasion of the first layer of fine rust on the brake blocks.

As an alteration in the insulation reducing the time constant to less than 1 second would not appear admissible, during the night of the 9/10th September 1958 an endeavour was made to improve the resistance of the insulation by giving it better protec-

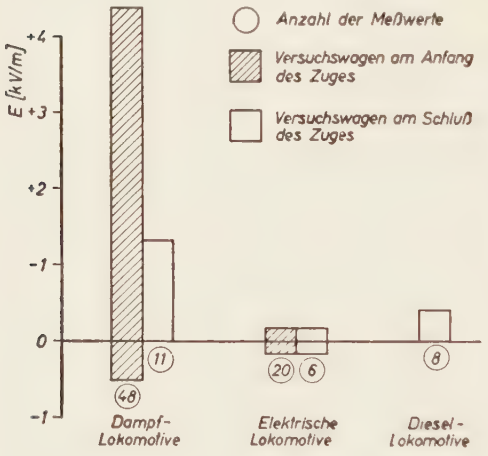


Fig. 12. — Average maximum field intensity on braking.

N. B. — Dampflokomotive = steam locomotive. — Elektrische lokomotive = electric locomotive. — Diesel-lokomotive = Diesel locomotive. — Anzahl der Messwerte = number of values measured. — Versuchswagen am Anfang des Zuges = test coach at front of train. — Versuchswagens am Schluss des Zuges = test coach at rear of train.

tion against humidity, whilst conserving in principle the insulating components. The protection of the insulators by means of temporary casings gave sufficiently good results during the rest of the tests for the time constant to be kept at a few minutes, even during wet weather, after having been restored initially to some 60 minutes. The results of the tests are therefore not comparable over the whole route, but are quantitively more usable than those for the short section between Munster and Norddeich.

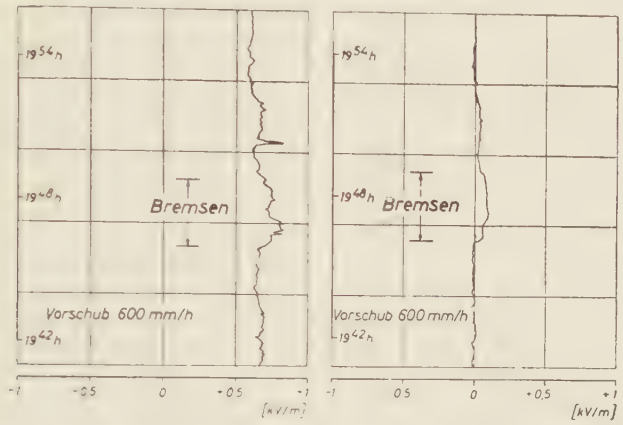
Figure 12 shows the average of the field intensities measured during braking for the different methods of traction. The fields which naturally show a wide dispersion from one to the other, have very characteristic average differences for steam locomotives on the one hand and diesel and electric locomotives on the other. It still remains to find out whether the measurements made with electric traction are influenced in anyway by the nature of the rheostatic brake which is used by itself up to a speed of 30 km/h and consequently causes less braking dust at high speeds.

In getting out the averages, the brakings on the Munster-Norddeich run were left out, on account of the errors in the measurements as explained above. Unfortunately in the case of Diesel locomotives, no records are available for cases when the recording coach was immediately behind the locomotive. In the case of electric locomotives also, the figures obtained are perhaps not strictly comparable with those for steam locomotives, because the measuring coach although in the front portion of the train was still separated from the locomotive by two coaches. However, the gap of more than 10 times exceeds by far the field of dispersion of isolated measurements and shows sufficiently that the steam locomotive gives rise to much higher charges during braking than electric locomotives (fig. 14) and perhaps also than Diesel locomotives (fig. 13).

However, it remains then to find out whether this result is connected in any way with the fact that with Diesel and electric locomotives, whose wheels are partly covered in, the electrified particles produced during braking do not come out so easily.

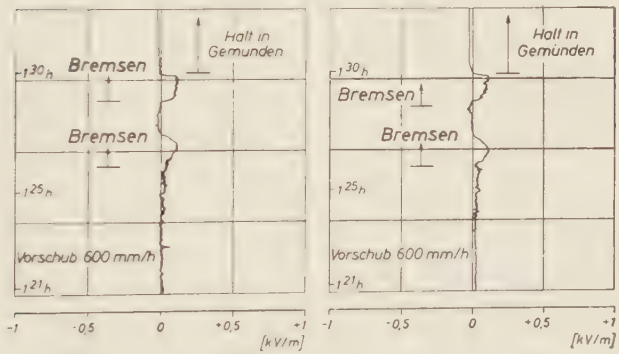
This determination of the averages also shows that there is a considerable and surprising difference up to a certain point between the fields produced by braking behind different types of locomotives when the measuring coach is coupled up at the back of a passenger train. Although the difference

between Diesel and electric locomotives, on the one hand, and steam locomotives on the other, is not so great in this case, it is still nearly five times, so that it appears fundamental although its cause cannot be given or even simply presumed from the measurements made. Unfortunately, the change in the method of traction, which depends entirely upon the operating and cannot be systematically controlled, means an absence of any measurements for cases where the measuring coach was included in the front portion of the train with Diesel traction, as well as when it was immediately behind an electric locomotive. For this purpose, it would be necessary to have systematic test



Measuring compartment 6 (compartment). Measuring compartment 3 (corridor).

Fig. 13. — Braking with Diesel traction. Test coach at rear of train. Munich-Wuppertal run, 12th September 1958. Train D 503.



Measuring compartment 3 (corridor). Measuring compartment 6 (compartment).

Fig. 14. — Braking with electric traction. Test coach third coach behind the locomotive. Norddeich-Munich run, 11th September 1958. Train D 48.

runs which would also take the above factors into consideration. Such tests might also reveal the physical causes of other observations noted in making up these averages. For example, negative charges which one only expects to find with steam traction, especially immediately behind the locomotive, have also been observed in the case of electric traction and precisely at the end of the train.

If the electrostatic phenomena do not simply contribute to the dirtying of passenger trains, but are the sole reason or at any rate the predominating reason, figure 12 would clearly show that coaches hauled by steam locomotives would get a great deal dirtier or get dirtier much faster than those hauled by Diesel and electric locomotives, and also that the coaches in the front portion of the train would be much more affected than those in the rear. From the information supplied by the Bundesbahn, there is in fact no such relation between the dirtying of the coaches and the kind of traction and position of the coach in the train. An analysis of another kind of the results of measuring a great number of brakings (fig. 15) also shows that the electrostatic influence on phenomena of dirt collecting is secondary. On the maximum value of the field intensities recorded at braking taken as abscissa, the « residual value » of the fields produced after the train came to a stop was taken as ordinates. In the majority of cases, residual negative fields correspond to the main positive fields. According to the types of record « *b* » and « *c* » of figure 5, this means that the phenomenon measured must be attributed solely to the influence of passing electrified aerosols. One cannot expect to have a systematic correlation of the value of the primary field and the residual field, because the duration of the primary field also intervenes, as well as its relation with the time constant of the insulation. Besides this main type of variation, in certain cases we get measurements where the positive residual fields succeed the principal positive fields. According to type *d* of figure 5, these correspond mainly to the case of a deposit on the measuring panel from the aerosol encountered. The preponderant existence of negative residual charges after a positive primary field is not even in contradiction with the fact that in general there is an electrified aerosol deposit on the measuring panels, because this occurs simply in the form of perturbation of the elimination of the part of the charge due to the influence. If consequently, the correlation diagram (fig. 15) brings out first of all the improbability of any electrostatic influence in the deposit of dirt, it does not exclude this possibility. This question cannot be solved without further tests. In any case, the hope of bringing into evidence deposits of electrified dust by the recording of the variation of the field during running was found to be fallacious, seeing that the fields in the neighbourhood of the measuring train occur essentially during braking, but not during normal running.

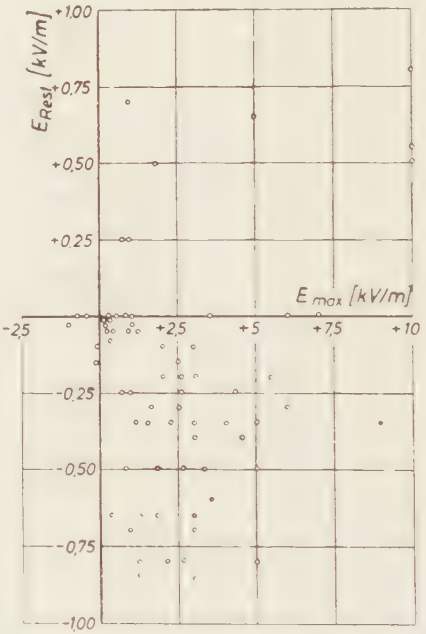


Fig. 15. — Correlation between space charge and intensity of residual field.

Finally, besides these numerous isolated

measurements taken during long trial runs, which can be broken down statistically, there are certain isolated observations which may be of interest in continuing these tests. On the Cologne-Beuel section, during an unexpected emission of steam during the test, which was heard in the measuring coach which was immediately behind the locomotive, it was surprising to record powerful positive fields, the sign of which is consequently opposite to the expected sign of the aerosols from the steam being run through. Soon after leaving Neuwied, there was an intentional emission of steam from the locomotive. Unlike the case when leaving Cologne, on this occasion, there were no positive fields. The recording only showed weak negative fields.

A repetition of the test before entering Niederlahnstein and after leaving Niederlahnstein again showed positive charges, but much lower in value. It was thought that perhaps the sign of the field was a function of the direction in which the steam was emitted, but it was not possible to confirm this because there is no means of communication during running between the coach and the locomotive.

As expected, the apparatus for measuring the field intensity makes it possible to measure the field not only when the surface of the measuring head is placed in the plane of the exterior wall of the coach, but also when it is held out of a window in the corridor. Figure 16 shows the field intensities measured at different places during shunting at Norddeich. We must make it quite clear that the differences are not due to the existing space charge at the measuring point, but to the geometry of the deformation of the field by the field test probe which the measuring apparatus is, which must be considered as being earthed. This measurement simply proves that the field intensity is of outside origin, and does not come from any charge on the body of the coach.

Although during running the measuring panels 1 to 6 in general did not show any exterior fields, a test made on leaving Mayence with a portable field measuring apparatus, held out of the window, some centimeters outside the rolling stock gauge, showed what appeared to be a systematic relation between the running speed and the field intensity similar to figure 17, the scale of ordinates of which can be considered as accurate, whereas the running speed used as abscissae is only based on the estimated speed. These measurements were found to be not reproducible. The formation of this indication of the field and the

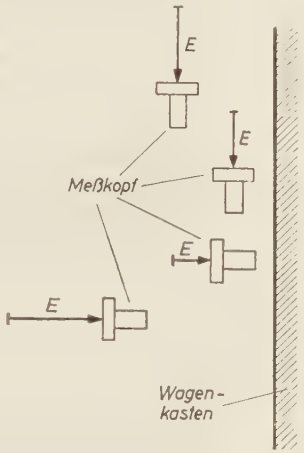


Fig. 16. — Profile of the distribution of the field intensities.

N. B. — Messkopf = measuring head. — Wagenkasten = body of coach.

relation between the running speed and the field shown could only be clarified by other tests in which it would be essential for the running speed to be indicated at least, and if possible recorded, in the measuring coach.

Nor is there any explanation for the results of a measurement of the « profile of the field », along the train by means of portable equipment, and at a constant running speed, the measuring head being in each case held in the same geometrical position outside an open window in the coach, not always the same window but always on the same side (fig. 18). In every case, the field was positive; behind the locomotive, with steam traction, it was about 5 kV/m:

as was expected, it began to decrease, but reached a definite maximum at the fourth coach, and a still higher one at the 8th coach. It showed right up to the last coach

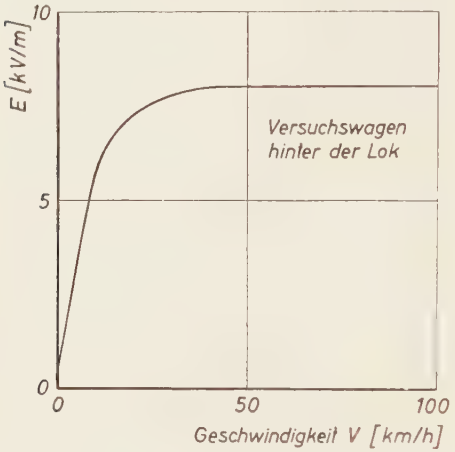


Fig. 17. — Intensity of the electric field of the air on starting with a steam locomotive.

N. B. — Geschwindigkeit = speed. — Versuchswagen hinter der Lok = test coach behind the locomotive.

of the fact that the train length was the same, not only was a weaker field obtained, but quite a different qualitative variation. The question therefore remains to be cleared up whether the profile of the field behind the steam locomotive is conditioned not only by the charge carriers it emits, but also by other electrostatical properties of the coaches in the sense of a production of electric loadings or a charge of the film of paint. The surprising result of measurements so far obtained does not make such a relation seem probable at the present time.

Figure 19 shows part of the 24 compartment test panel after first getting dirty on arrival at Norddeich. The panels charged at $\pm$ 1 000 V are not different from the point of view of the dirt picked up to those with no charge with which they alternate in chequer board fashion. The preliminary voltage was then increased to $\pm$ 5 000 V for the remainder of the test without the condition as regards dirt being systematically influenced (fig. 20). When examining this figure, the four lowest compartments in the middle should not be taken into account; their condition will be discussed later on.

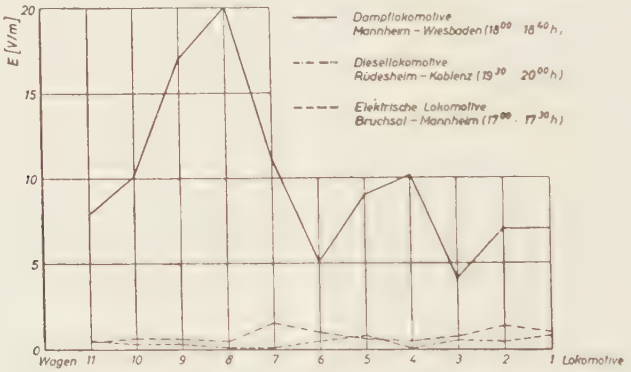


Fig. 18. — Variation in the field intensities along a train. Measuring run Munich-Wuppertal, 12 September 1958. Train D 503.

on the train, always remaining higher than the field at the leading coach . At more or less the same running speed, with an identical composition of the train, behind a Diesel or electric locomotive, however, in spite

On the surface of the panel charged at 1 000 V, the field intensities are only of the order of some V/cm, which likewise can only exert very feeble effects upon the charged particles in the current of air passing over

them. The range is extremely feeble, in any case much feebler than would be expected from the force between the electrified particle and the wall of the uncharged compartment covered with paint. The absence of any influence of the polarity of the preliminary charge on the dirtying is therefore no proof of the contributory part of electrostatic influences.

A much more instructive observation, however, is that made at Norddeich on the adhesion of a fresh layer of dirt on a large test panel. The length of the run as far as Norddeich was 6 hours, and a shower of rain occurred during the last 4 hours. On the test panel, it could be clearly seen that a drop of rain, first of all pushed towards the rear of the train by the running wind,

Fig. 19. — Part of the 24 compartment test panel after first getting dirty at Norddeich.

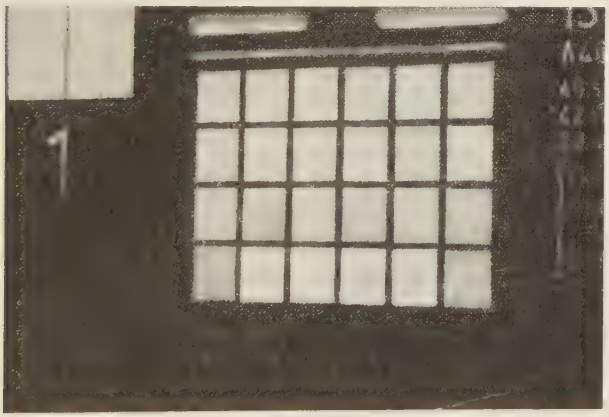


Fig. 20. — Twenty-four compartment test panel with neutral, positive and negative plates after arrival at Wuppertal.

picked up other small drops and finally became so heavy that it fell practically vertically. It then had sufficient detergent power to remove part of the deposited dust and consequently leave its own track. The drop which evaporated soon afterwards, left below it the dirt it had collected.

The adhesive power of the dirt was therefore so little that rain, in other words distilled water, without acid or alcaline addition, could break the link between the dirt and the surface of the coat of paint. This observation is surprising because practical experience has taught us that old dirt can only be removed with difficulty even when basic or acid products are added to the washing water.

Although it is still not possible to define the importance of the part played by electrostatics in the accumulation of dirt on the surface of the paint, it is in any case certain that even in the case of a particle with the highest charge, the electrostatic forces are absolutely insufficient to give rise to any lasting liaison. In view of the excellent insulating properties of the coat of paint, each particle abandons its charge on the coach body within a few minutes, and at the very longest after a few hours. The electrostatic liaison disappears therefore in the end, so that it should be possible to remove the dirt by dusting or blowing it off. If one is inclined to allow electrostatic liaison of the dirt, a distinction must be made with great care between the liaison of the deposit and the liaison of adhesion. The electrostatic forces are sufficient for a momentary deposit; they are not sufficient to explain any lasting adhesion, and still less the increase in such adhesion after the dirt has been deposited for any length of time. This observation leads us to think that the adhesion is not electrostatic by nature, but chemical. However, the chemical forces in question might very well be electrical in nature, seeing that the surface of the organic paintwork certainly possesses polarisation properties, and the particles of dust also possess such properties. The two conditions may be further increased by humidity or rain water, which in the primary stage, owing to its high dielectric constant, is capable no doubt of overcoming the forces of accumulation, but on the other hand may strengthen the liaison of adhesion when it can enter into chemical liaison with both the surface of the dirt and the polar heads of the surface of the paint.

By means of the laws of static magnetism, it is also possible to calculate in an approximate fashion the forces with which a non-magnetic particle or a magnetized particle can be retained through the coat of paint on the metal surface. The calculation shows that according to the thickness of the coat, its own magnetic properties and those of the carrier, such forces may be once, and possibly even two times greater than the maximum possible electrostatic forces.

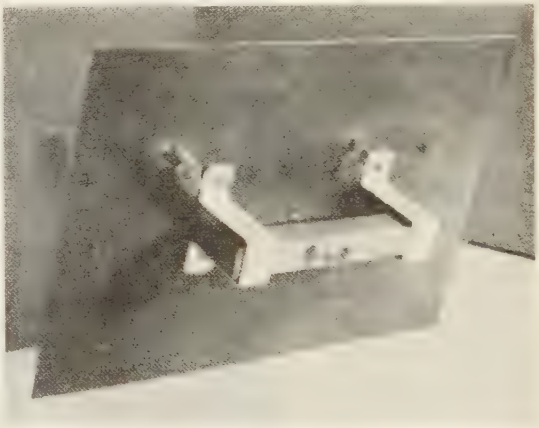


Fig. 21. — Arrangement of the magnets on the back of the test panels.

Here, the existence of non-homogeneous fields at the frontiers between the regions of magnetization of an apparently non-magnetic sheet of steel has perhaps a more important role than the existence of homogeneous fields. This is why a test was made from Würzbourg on the influence of non-homogenous magnetic fields by replacing the four lower painted steel panels of the 24 compartment measuring panel by sheets of aluminium painted on the back, to which were connected magnets of alternate polarity with slightly magnetised pole pieces (fig. 21). On arrival at Munich (fig. 22), the annular contour of the magnet poles, where the lack

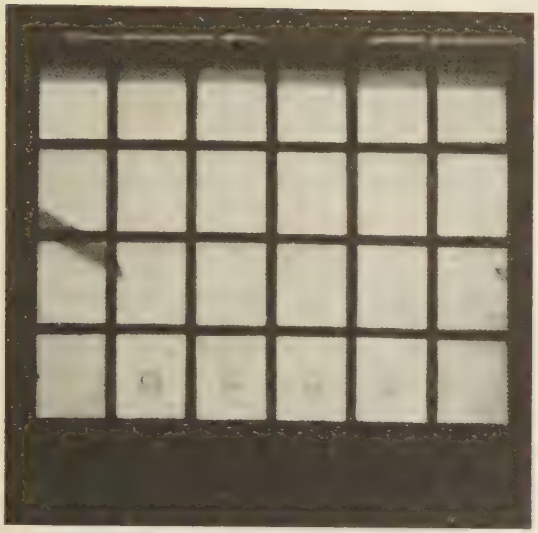


Fig. 22. — The 24 compartment test panel at Munich.

of homogenity of the magnetic field is the greatest, could definitely be recognised from the amount of dirt. If all these panels look cleaner than the other 20, this is because they were only exposed to dirt for a shorter period. But even when the general dirtying of the panel continues to increase, the ring remains a very clearly visible zone of dirt. Figure 23 shows the condition on arrival at Wuppertal, after 14.5 hours on the run in all but with the magnetic field. One striking phenomenon, which perhaps cannot be explained at present, is the apparently reciprocal increase in dirt due to the influence of a « projection spot » and the magnetic field.

It has therefore been shown that the magnetic forces can cause an accumulation of dirt. But the fields, which they set up, do not weaken as time goes on like the charged particles. They remain intact even after the deposit of dust and thus set up, even without the influence of additional chemical forces, a liaison of adhesion. The necessary preliminary condition for this is naturally the existence of a sufficiently powerful magnetic field, which was to some extent roughly imitated by means of the systems of magnets. But in actual fact, such fields always exist in principle. In addition, the brake dust, even when reduced to infinitesimal particles and consisting solely of ferric or ferrous oxide without even a core of solid iron, generally possesses a permanent magnetism up to saturation. The particles can be sufficiently small so that each of them is only a single Weiss area in each of which there is total saturation, even in the « macroscopically non-magnetic iron ». The fields issuing from this micro-dipole can cause the particle to stick with its axis parallel to the surface of the sheet against the coat of paint, if the sheet is of iron. Naturally, these forces would not exist in the case of aluminium sheets. All the dirt accumulating outside the zone of the magnetic field is therefore not connected magnetically in this way, so that the magnetic influences also must not be considered as the only ones in question. Figure 24 and 25 show enlarged portions of the test panels fitted near the measuring windows. They clearly show that the dirt forms grooves on the surface of the paint. These grooves probably run horizontally; it is possible that on one of the sheets they were also vertical. But what is certain is that they are no more oblique than appears in the figure; therefore they do not follow the flow of the rain down the surface of the paint. The stripped effect

Fig. 23. — State of dirt on a painted aluminium test panel close to the magnetic pole after arrival at Wuppertal.

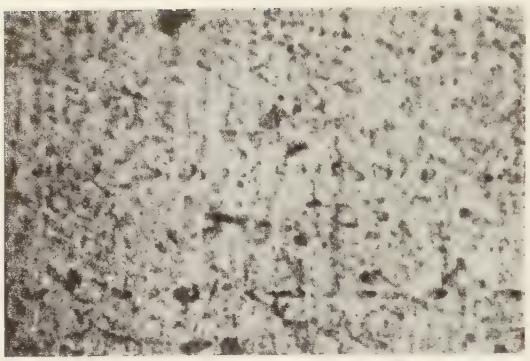


Fig. 24. — Striped pattern of the dirt on the surface of the paint.

may also result from the fact that the dipole character of the particles of iron and the design of the texture of the rolled steel sheets combined have increased the forces and caused the formation of grooves. Here again, other tests will be required to elucidate the question.

The test runs gave a certain number of results as a contribution to the problem of the origin of the dirtying, but they in no way solved all these problems. These results can be briefly summed up as follows :

1) in the immediate neighbourhood of a passenger train, there are important aerosols carrying a space charge of positive and negative character. The positively charged brake dust plays a special role here;

2) the electrostatic environment of a passenger train depends essentially on the method of traction (steam, Diesel or electric). The differences are at least of one order of magnitude, i.e. at least a power of 10;

3) the electrostatic forces can lead to the deposit of dirt on the surface of the paint, but not to its adhesion. If they are definitely lower than the magnetic forces causing the accumulation of dust, they are of analogous order of magnitude and sufficient;

4) freshly deposited dust adheres so lightly that it can be washed off with pure water. The strong adhesion which occurs after a certain time, which is probably due to a chemical liaison, cannot be broken, from experience acquired, except with the aid of acid or basic products and at considerable expense.

Résumé.

The article describes the measuring installation and test runs intended to throw light upon electrostatic influences in the dirtying of passenger coaches. The results obtained are commented upon. It has been found that there are aerosols around passenger trains which carry the space charge. The value of the charge is influenced by the method of traction. The electrostatic forces can lead to the deposit of dirt, but not to its adhesion.

Bibliography.

[1] « Elektrisitätswirtschaft », 42, 1943, No. 6, pp. 120-123 (20th March 1943).

[2] « Melliand Textilberichte », Heidelberg, Vol. XXXIV, No. 12, 1953, pp. 1182-1185.

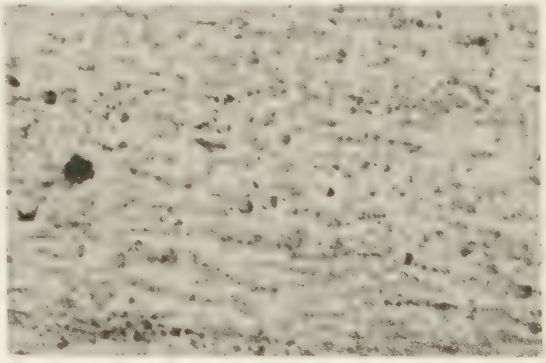


Fig. 25. — Striped pattern of the dirt on the surface of the paint.

[656 .224 (44)]

The new organisation of the restaurant services on S.N.C.F. trains for large groups of passengers.

(*Revue Générale des Chemins de fer*, March 1961.)

The International Sleeping Car Company (CIWL) has just put into service a new organisation intended to speed up the preparation and serving of quick service meals to large numbers of passengers travelling together in groups. Our readers will find below a report of the bases of this organisation from details which the Traffic Department of the S.N.C.F. has kindly supplied to the « Revue Générale ».

The « CIWL » is going to make use of special coaches for the preparation and serving of quick service meals to large groups of passengers.

Work table and special food racks.

This is a new type of restaurant service : the problem of serving large numbers quickly and more or less simultaneously arose in the case of trains booked by Travel Agencies, and this has been solved in two different ways according to the type of service desired :

1) the classic type of restaurant service, with one or 2 dining cars, and meals served over periods of several hours;

2) quick service meals, which allow of shorter hours and lower prices.

From its experience, the « CIWL » estimated that it would have to prepare 200 000 to 220 000 quick service meals during the 1961 summer season. To assure such a service under the best possible conditions, they intend to generalise the method they tried as an experiment in 1960, which consists in preparing these quick service meals in special cars, after which they are served very quickly from special food racks.

The tests carried out showed that the preparation of the dishes, and stocking them before and after use, involved in the case of groups of more than 100 passengers having a special vehicle; for groups of more than 500 passengers, in general a second vehicle was necessary, but this being mainly required for supplies could consist of an ordinary van.

The special coaches required were selected from old restaurant cars. The tables and seats were removed, and the space thus made available was used :

— to erect staging all along one wall and a working table covered with zinc for the preparation of the dishes;

— to equip the other wall with the special food racks with metal fittings intended to take the prepared dishes;

— to stock the different supplies required not only for the quick service meals properly speaking, but also for breakfast and a snack trolley.

The long working table fitted forms a veritable « assembly line » for the preparation of these dishes.

Each man working at this table is responsible for one of the items of the meal. The plates, sliding all the way along the table pass in front of each man in turn. At the end, they are wrapped in a polyethylene bag and put in the spaces in the special food racks on the opposite wall.

The « kitchen » part of the coaches is used for the making of coffee and should the need arise certain cooked items, as well as for keeping provisions on ice and cooling the drinks.

As regards the distribution of the meals on the train, each man can carry 2 food racks each containing 6 plates, so that he can in this way serve meals to 2 complete compartments of the couchette-cars.

With these special restaurant cars and adapted vans, it is possible to prepare 500 quick service meals and then serve them in about one hour, whereas on an ordinary restaurant car only 250 meals can be served in 5 sittings, i.e. in about 5 hours.

P. M

[625 .142 .4 (73)]

Automate production of concrete ties,

by Charles W. Donnelly.

(*Modern Railroads*, February, 1961.)

Automatic machine that casts prestressed concrete ties is part of mass-production system that includes all steps in tie-making.

Prestressed concrete ties are now available in quantity. Since last october, with the completion of fully automated curing, storage, and shipping facilities to supplement refinements added to its tie-casting machine, the American Concrete Crosstie Corp. in Tampa has been maintaining a production rate of 50 prestressed ties a day. Potential production is 1 000 ties a day.

These ties are identical with the concrete

ties laid in quarter-mile sections of ACL and SAL track last year except that 28-day concrete compressive strengths have been increased from 6 000 psi to 8 500 psi. (See Modern Railroads, May 1960, p. 124.)

The tie-casting machine, designed and developed by American Concrete Crosstie can complete a prestressed tie every 26 seconds if desired. All phases of the cycle to produce the concrete tie — casting, prestressing, curing and movement to storage and shipping areas — are automatic. Thus a complete tie-making plant requires only a manager and a limited number of personnel.

To form a tie, an unstressed pallet enters the casting machine and moves on roller conveyors to a point where a total of 82 000 lb of stress is applied to four strands of wire. Next, the stressed pallet moves to a vibrating table. Here, in conjunction with a mold box and a pressure plate, the pallet aids in forming a tie of dry, high-strength concrete. The concrete is deposited by a distributing hopper. Bolt holes are also cast at this time.

Seconds after this phase of the operation is completed, the mold box, pressure plate, and bolt-hole forming pins are removed. The free standing crosstie, with cable tension still maintained by the pallet, then moves to a power distribution control center.

At this center, hydraulically-operated cradle cars store 36 ties to await transportation to steam chambers where a 14-hour curing process takes place. When curing is completed, a master control continues the cycle, returning the prestressed concrete ties to storage and shipping areas. The released pallets are then returned to the casting machine to begin another production cycle.

[385. (06 .111]

OFFICIAL INFORMATION

ISSUED BY THE

PERMANENT COMMISSION

OF THE

International Railway Congress Association.

MEETING OF THE PERMANENT COMMISSION, held on the 2nd JUNE 1961.

The Permanent Commission of the International Railway Congress Association held a meeting on June 2, 1961, at 3.30 p.m., in the Belgian National Railways Headquarters Offices at Brussels.

* * *

Mr. DE VOS, *President*, opening the meeting, addressed a warm welcome to the personalities present.

He then paid a tribute to the memory of Mr. Jean GOURSAT, *Manager of the North Region of the French National Railways and Vice-President of the Association*, who died at the end of June 1960 (*The Assembly stood silent during a minute in memory of the deceased*).

The PRESIDENT submitted to the approval of the Meeting the Minutes of the Sessions held in Brussels on June 27 and 29, 1960.

They were ratified by the Assembly.

* * *

The PRESIDENT proposed to confer the high office of *Vice-President*, which was occupied by Mr. GOURSAT, to Mr. DARGEOU, *General Manager of the French National Railways*, who therefore becomes a Member of the Executive Committee.

— *Unanimously approved.*

* * *

The PRESIDENT informed the Assembly of the modifications which occurred in the constitution of the Permanent Commission since the Brussels Meeting of June 1960, and submitted the following proposals for the nomination of members of the Permanent Commission;

Mr. C. MARTIN, Manager of the Rolling Stock and Traction of the French National Railways, to take over the mandate of Mr. GOURSAT as member of the Permanent Commission;

Mr. J.L. HARRINGTON, Chief Shipping and International Services Officer, British Transport Commission, for one of the two vacant mandates among the British delegation;

Mr. P.C. KAPOOR, Railway Adviser to the High Commissioner for India, London, to succeed to Mr. L.T. MADNANI, at present in charge of other functions in India.

Mr. G. TANI, Director of the Foreign Department, Japanese National Railways, to replace Mr. H. SAITO, called to other functions.

Mr. L. ARMAND, General Secretary of the I.R.U., to replace Mr. J. TUJA, who has another post. Mr. L. ARMAND is already Member of Honour of the Permanent Commission and therefore he becomes again an active member of the Commission.

— *The Assembly ratified these proposals.*

(*The complete list of Members of the Permanent Commission is given in Appendix.*)

* * *

Prof. Dr. jur. H.M. OEFTERING, *First President of the Deutsche Bundesbahn, and President of the Organizing Committee*, gave particulars of the measures already taken by the German Authorities for the organisation of the next Munich Congress.

He confirmed the dates fixed for the Congress, i.e. from June 17 to June 27, 1962, and gave information about the programme of the works of the Session and of the excursions arranged in favour of the delegates. He mentioned the travelling facilities which will be probably granted in Germany to the participants and their family.

He ended his report by stating that the arrangements are in full progress and expressed his hope that the delegates will keep the best memories of their sojourn in Germany.

The GENERAL SECRETARY stated that the questionnaires relative to the ten questions on the agenda of the Munich Congress had been sent in due time to the affiliated Administrations and that the publication of the reports will start very likely in September or October next.

He then gave the names of the reporters designated for the study of the various questions as well as the names of the special reporters.

Furthermore, he mentioned that the following personalities had been chosen as *Presidents of the Sections.*

SECTION I :

M. E. KESSLER, Direktor bei der Hauptverwaltung der Deutschen Bundesbahn, Leiter der Bauabteilung;

SECTION II :

Dr. Ing. A. D'ARBELA, Directeur Central du Service du Matériel et de la Traction à la Direction Générale des Chemins de fer de l'Etat Italien;

SECTION III :

M. R. GUIBERT, Directeur Général Adjoint de la Société Nationale des Chemins de fer français;

SECTION IV :

Mr. J.E.M. ROBERTS, Director of Training and Education, British Railways;

SECTION V :

M. A. SJÖBERG, Directeur des Finances

à la Direction Générale des Chemins de fer de l'Etat Suédois.

— *The Assembly approved these nominations.*

* * *

The General Secretary gave particulars of the financial situation during the year 1960, and the final account of receipts and expenditure relative to that year was adopted.

He then recalled to the Meeting that at the Brussels Session on June 27, 1960, it was decided to fix the amount of the variable contribution to Gold.fr.0.21 per kilometre and that concerning the subscription for the year 1962 and following ones, the question should be reconsidered during the first half of the year 1961.

After thorough study of the question, the Executive Committee proposed for 1962 to come back to the amount adopted in 1951, i.e. Gold-fr 0,28.

— *Adopted.*

* * *

Publication of a German and a Russian edition of the Bulletin of the Association.

The General Secretary stated that the Deutsche Bundesbahn has asked to restart the publishing of a German edition of *the Bulletin* and consequently of its supplement « The Electric Traction on the Railways ».

He recalled that the German edition was suspended in June 1940.

From negotiations going on with the Deutsche Bundesbahn, it results that this Administration would be willing to take arrangements in order that the cost of publishing would not constitute a new expenditure to be supported by the Association.

It is proposed to give power to the Executive Committee to continue the talks concerning these arrangements in order to permit the publishing of the German editions from January 1962.

— *Approved.*

* * *

The Management of the International Communications of the Ministry of Communications of the U.S.S.R. has submitted to the Permanent Commission a request for the realisation of a Russian edition of the *Bulletin*.

After recalling that before 1914 negotiations were started on this question and that the Russian Railways were willing to support the cost of publishing, it is proposed to establish in agreement with the Ministry of Communications a special Committee to set out the conditions of realisation.

Mr. Wyrzykowski, *Vice-Director of the Scientific Institute for Trials and Researches of the Polish State Railways*, underlining the important mileage of the railway systems of Slav-speaking peoples asked for the Russian edition to be treated on the same bases as the German edition.

It was pointed out to Mr. Wyrzykowski that both editions were treated on the same bases.

Mr. Ivanov, *Technical Sciences Candidate, Director of the Railway Scientific*

Institute of the U.S.S.R., agreed to the constitution of a special Study Committee for this question, including Mr. WYRZYKOWSKI and himself.

— A first meeting of this Committee will take place the following day, June 3.

* * *

The Assembly heard the changes in membership since the last Brussels Meeting of 1960.

As new membership, mention must be made of the *Compania del Ferrocarril de Langréo*, operating a system of less than 100 km, but assuring a considerable traffic.

The economic importance of this railway system, being confirmed by Mr. GARCIA-LOMAS, *Vice-President of the Administrative Council of the R.E.N.F.E.*, the Assembly agreed to depart exceptionnally from the stipulations of article 4 of the Rules and Regulations specifying a minimum mileage of 100 km of operated lines.

The resignation of the *S.A. des Railways Economiques de Liège-Seraing et Extensions*, with a mileage of 21 km has been recorded.

It is also pointed out that the railway system known previously as « Société des Chemins de fer de Damas-Hama et Prolongements » is affiliated now under the name « Chemins de fer de l'Etat Libanais ».

The Association include at present 32 Governments, 12 Organisations and 100 Railway Administrations, with a total mileage of 595.293 km (369.900 miles approx.)

* * *

The GENERAL SECRETARY gave some information about the « Bulletin Sales » and « Advertising » departments of the Association.

* * *

Before the closure of the session, the PRESIDENT recalled to the participants the International Railway Union's proposal to develop their general information service in favour of the member railway systems, proposal which was communicated in due course to all the members of the Permanent Commission.

At this point, Mr. SQUILBIN, *Assistant to the General Secretary*, gave precise details on the various services offered in the field of information by the Association.

After a detailed report on the present activities of the Association, Mr. SQUILBIN suggested various measures able to increase the efficiency of the Association in the field of information and in particular :

— the publication of the results of separate investigations;

— the systematic study of the questions suggested by our adherents which have not been put on the agenda of a Congress or of an Enlarged Meeting of the Permanent Commission;

— the extended research of original papers;

— the coordination of the action of the I.R.C.A. with that of the I.R.U., A.A.R. and the Panamerican Congress.

At the demand of the PRESIDENT, Mr. RATTER, *Member of the British*

Transport Commission and President of the I.R.U., stated that in fact intensive technical studies are undertaken by the I.R.U. and they desire to put the results of their investigations at the disposal of the railway systems concerned in particular those of remote countries.

He recommended in this case close liaison between the I.R.U. and the I.R.C.A. and proposed the creation of a Committee of high officials to find out the lines on which this could be arranged.

The President thanked Mr. Ratter for his proposal aimed at supplying documentation to remote countries, not in a position to follow closely the I.R.U.'s work, and he asked the opinion of the participants on this proposal.

Prof. Dr. jur. Oeftering gave his approval and said that he wished a final and satisfactory solution of the question for both organisations.

Sir John Benstead, *Deputy Chairman of the British Transport Commission*, also supported the proposal, as well as Mr. Lamalle, *Member of Honour of the Association*, who pointed out that the independence of the I.R.C.A. must however be preserved.

The President thanked Mr. Ratter as well as the personalities, who expressed their opinion on his proposal, which he considers constructive and capable of bringing successful results.

— The meeting ended at 5.30 p.m.

The General Secretary, *The President*,

(s) P. Ghilain (s) Mr. De Vos.

List of Members of the Permanent Commission

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(JUNE 2, 1961.)

President :

M. **De Vos** (1), Directeur Général de la Société Nationale des Chemins de fer belges; 19, rue du Beau-Site, Bruxelles.

Vice-Presidents :

Ph. Dargeou (1), Directeur Général de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IX^e);

M. **Crem** (2), Directeur du Service de l'Exploitation de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles

Members of the Executive Committee :

E. **Dorges** (1), Secrétaire Général Honoraire aux Travaux Publics et aux Transports, Délégué Général aux Affaires Internationales du Ministère des Travaux Publics, des Transports et du Tourisme; 244, boulevard Saint-Germain, Paris;

Sir John **Benstead** (2), Deputy Chairman of the British Transport Commission; 222, Marylebone Road, London, N.W.1;

Sir James **Dunnett** (3), Permanent Secretary, Ministry of Transport (Great Britain); St. Christopher House, Southwark Street, London, S.E.1.

Ex-presidents of session, members ex-officio :

D^r Ing. G. **di Raimondo**, Directeur Général des Chemins de fer italiens de l'Etat (*retired*); Via Mercadante, 8, Rome;

Ibrahim Fahmy **Kerim**; Le Caire;

D^r W. **Meile**, ancien Président de la Direction générale des Chemins de fer fédéraux suisses; Brügglerweg, 11, Berne;

A. **Plana**, Sous-Secrétaire d'Etat aux Travaux Publics et Président du Conseil d'Administration du Réseau National des Chemins de fer espagnols; Madrid.

The Rt. Hon. Lord **Robertson**, Bart., G.C.B., G.B.E., K.C.M.G., K.C.V.O., D.S.O., M.C., Chairman, British Transport Commission 1953-1961, Iles Green, Far Oakridge, Gloucestershire.

Members :

E.T. **Aalto** (1), Directeur Général des Chemins de fer de l'Etat de Finlande; Helsinki;

Mohamed **Afifi** (1), Directeur Général des Chemins de fer de la République d'Egypte; Le Caire.

Dr. C.S. **Andrews** (1), Chairman of the Córas Iompair Éireann; Kingsbridge Station, Dublin;

L. **Armand** (3), Secrétaire Général de l'Union Internationale des Chemins de fer; 10, rue de Prony, Paris;

Abdel Moneim **Azmy** (1), Sous-Secrétaire d'Etat au Ministère des Communications d'Egypte; Le Caire;

Sir John **Benstead** (already named);

R. **Besnard** (3), Chef de Service adjoint au Directeur général des Chemins de fer et des Transports, Ministère des Travaux publics, des Transports et du Tourisme; 244, boulevard Saint-Germain, Paris;

David **Blee** (1), General Manager, London Midland Region, British Railways; Euston Station, London, N.W.1;

Ing. F. **Boomstra** (1), Ingénieur en Chef au Ministère des Transports et du Waterstaat; La Haye;

Dr. H. **Born** (2), Directeur de l'Union d'Entreprises Suisses de Transport; Bundesgasse 28, Berne;

Dr. L. **Branca** (1), Vice-Directeur Général des Chemins de fer italiens de l'Etat; Rome.

---

(1) Retires at the 18th session.
(2) Retires at the 19th session.
(3) Retires at the 20th session.

A. **Brouckaert** (3), Directeur du Service du Matériel et des Achats de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

E. **Clarembaux** (1), Directeur du Service de la Voie de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

M. **Crem** (already named);

G. **Csanadi** (2), Premier Adjoint du Ministre des Communications et des Postes (Hongrie); Budapest;

Dr Ing. A. **Cuttica** (1), Directeur Général Adjoint et Conseiller d'Administration des Chemins de fer italiens de l'Etat (*retired*); Rome;

Ph. **Dargeou** (already named);

J. **de Aguinaga** (3), Directeur Adjoint du Réseau National des Chemins de fer espagnols; Madrid;

E. **Derijckere** (3), Directeur du Service de l'Electricité et de la Signalisation de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

M. **De Vos** (already named);

M. **Dias Trigo** (2), Directeur des Services d'Exploitation et du Matériel de la Direction des Transports terrestres au Ministère des Communications du Portugal; Lisbonne;

Dr Ing. G. **di Raimondo** (already named);

E. **Dorges** (already named);

A.R. **Dunbar** (2), Manpower Adviser, British Transport Commission; 222, Marylebone Road, London N.W.1;

Sir James **Dunnett** (already named);

J.M. **Garcia-Lomas** (3), Vice-Président du Conseil d'Administration du Réseau National des Chemins de fer espagnols; Madrid;

H. **Geitmann** (1), Präsident der Deutschen Bundesbahn; Friedrich-Ebert-Anlage, 43-45, Frankfurt (Main);

Dr. Ing. P. **Giobbe** (1), Directeur du Service du Personnel et des Affaires Générales des Chemins de fer italiens de l'Etat (*retired*); Rome;

K.W.C. **Grand** (3), Member, British Transport Commission ; 222, Marylebone Road, London, N.W.1;

Dr H. **Gschwind** (3), Président de la Direction Générale des Chemins de fer fédéraux suisses; Berne;

R. **Guibert** (3), Directeur Général Adjoint de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IXe);

J.L. **Harrington** (2), Chief Shipping and International Services Officer, British Transport Commission; 222, Marylebone Road, London N.W.1;

F. **Hebert** (3), Directeur Général Adjoint de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IXe);

R. **Hoens** (2), Directeur Général de la Société Nationale belge des Chemins de fer vicinaux; 14, rue de la Science, Bruxelles;

I.A. **Ivanov** (2), Candidat des Sciences Techniques, Directeur de l'Institut Scientifique des Chemins de fer de l'U.R.S.S.; Moscou;

M. **Jacobshagen** (3), Direktor bei der Hauptverwaltung der Deutschen Bundesbahn; Friedrich-Ebert-Anlage, 43-45, Frankfurt (Main);

P.C. **Kapoor** (3), Railway Adviser to the High Commissioner for India in London; Government Building, Bromyard Avenue, Acton, London, W.3.;

Ibrahim Fahmy **Kerim** (already named);

Dr. Ing. Moustapha **Khalil** (2), Ministre des Communications d'Egypte; Le Caire;

R. **Kunz** (3), Directeur de l'Office fédéral des transports; Berne;

Dr N. **Laloni** (2), ancien Directeur Général Adjoint des Chemins de fer italiens de l'Etat; Rome;

Brig. Ch.A. **Langley** (3), Chief Inspecting Officer of Railways, Ministry of Transport; St. Christopher House, Southwark Street, London, S.E.1.

J. **Lohmann** (2), Président des Chemins de fer Néerlandais, S.A.; Utrecht;

D.P. **Loomis** (1), President, Association of American Railroads; Transportation Building, Washington, 6. D.C.;

P. **Lorenzo Ochando** (3), Director General de Ferrocarriles, Tranvias y Transportes por Carretera; Madrid;

W.H. **Maass** (1), Advisory Engineer to the High Commissioner for the Union of South Africa; South Africa House, Trafalgar Square, London, W.C.2.;

(1) Retires at the 18th session.
(2) Retires at the 19th session.
(3) Retires at the 20th session.

M. **Malderez** (3), Secrétaire Général du Ministère des Communications de Belgique; 17 *a*, rue de la Loi, Bruxelles;

R.F. **Marriott** (2), Advisory Engineer, Representative of the New Zealand Government Railways, New Zealand House; 415, Strand, London, W.C.2;

C. **Martin** (2), Directeur du Matériel et de la Traction de la Société Nationale des Chemins de fer Français; 20, rue de Rome, Paris (VIII^{e});

D^{r} W. **Meile** (already named);

Ing. Z. **Modlinski** (3), Sous-Secrétaire d'Etat au Ministère des Communications de Pologne; Varsovie;

J.P. **Musquar** (2), Directeur Général de la Société Nationale des Chemins de fer Luxembourgeois; 17, rue du Nord, Luxembourg;

P. **Nolet de Brauwere** (1), Secrétaire Général Honoraire de la Société Nationale des Chemins de fer belges; 121, avenue F. Lambeau, Bruxelles;

Prof. Dr. jur. H.M. **Oeftering** (2), Vorsitzer des Vorstandes und Erster Präsident der Deutschen Bundesbahn; Friedrich-Ebert-Anlage, 43-45, Frankfurt (Main);

A. **Plana** (already named);

J. **Puig Batet** ()), Directeur Adjoint du Réseau National des Chemins de fer espagnols, Directeur de la 5^{e} zone; Estación de Termino, C/ Ocata, 1, Barcelone;

J. **Ratter** (1), Member of the British Transport Commission; 222, Marylebone Road, London, N.W.1;

P. **Renaud** (1), Vice-Président du Conseil d'administration de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IX^{e});

Dr. Ing. S. **Rissone** (2), Directeur Général des Chemins de fer italiens de l'Etat; Rome;

The Rt. Hon. Lord **Robertson** (already named);

Dr.-Ing. E. **Roscioni** (2), Inspecteur Général Supérieur de la Motorisation Civile et des Transports concédés au Ministère des Transports (Italie) (*retired*); Rome;

Dj. **Savičević** (3), Directeur Général Adjoint des Chemins de fer Yougoslaves; Belgrade;

D^{r} M. **Schantl** (1), Directeur Général des Chemins de fer fédéraux autrichiens; 9, Elisabethstrasse, Vienne I;

Dr. F. **Schelp** (1), Mitglied des Vorstandes und Präsident der Deutschen Bundesbahn; Friedrich-Ebert-Anlage, 43-45, Frankfurt (Main);

H.E. **Simpson** (2), President, Baltimore and Ohio Railroad Company; Baltimore, Md.;

Karnail **Singh** (1), Chairman, Railway Board, Ministry of Railways, Government of India; New Delhi;

P.E.N. **Skov** (1), Directeur Général des Chemins de fer de l'Etat danois; 40, Sölvgade, Copenhague, K;

Shinji **Sogo** (3), Chairman of the Board of Directors, Japanese National Railways; Kokutetsu Building, 1-1, Marunouchi, Tokyo;

R. **Soulard** (1), Directeur du Mouvement de la Société Nationale des Chemins de fer français; 8, rue de Londres; Paris (IX^{e});

H.E. **Stokke** (3), Directeur Général des Chemins de fer de l'Etat norvégien; Oslo;

G. **Tani** (3), Director of the Foreign Department, Japanese National Railways; Chiyodaku, Tokyo;

E.G.J. **Upmark** (3), Directeur Général des Chemins de fer de l'Etat suédois; Stockholm;

R. **Vaubourdolle** (3), Directeur des Installations Fixes de la Société Nationale des Chemins de fer français; 42, rue de Châteaudun, Paris;

F. Perez **Villamil** (3), Directeur Adjoint du Réseau National des Chemins de fer espagnols; Madrid;

W. **White** (1), President, Delaware & Hudson Railroad Corporation; 230, Park Avenue, New York 17;

O. **Wichser** (2), Directeur Général, Chef du Département des Travaux et de l'Exploitation des Chemins de fer Fédéraux Suisses; Berne;

Dr. Ing. W. **Wyrzykowski** (2), Vice-Directeur de l'Institut Scientifique des Essais et des Recherches Ferroviaires des Chemins de fer de l'Etat Polonais; Varsovie;

N..... (3) Argentina.	N..... (1) Egypt.
N..... (1) Argentina.	N ... (2) Great Britain.
N ... (2) Belgium.	N .... (3) Roumania.
N..... (3) Bulgaria.	N..... (3) Spain.
N..... (3) China.	N..... (3) Switzerland.
N ... (1) Czechoslovakia.	N..... (2) U.S.A.

(1) Retires at the 18th session.
(2) Retires at the 19th session.
(3) Retires at the 20th session.

Honorary President : F.H. **Delory,** Directeur Général honoraire de la Société Nationale des Chemins de fer belges; 2, avenue Curé Glibert, Rixensart.

Members of Honour : O.V.S. **Bulleid,** former Chief Mechanical Engineer, Córas Iompair Éireann, and former Chief Mechanical Engineer, Southern Region, British Railways; 2, Fairfield Close, Exmouth, Devon.

P. **Ghilain,** Directeur honoraire du Service du Matériel et des Achats de la Société Nationale des Chemins de fer belges, Secrétaire Général de l'Association; 19, rue du Beau-Site, Bruxelles.

Ranald J. **Harvey,** Consulting Engineer; 34, Victoria Street, Westminster, London, S.W.1.

The Rt. Hon. Lord **Hurcomb,** G.C.B., K.B.E., Chairman, British Transport Commission 1947-53; 47, Campden Hill Court, Campden Hill Road, Kensington, London W. 8.

U. **Lamalle,** Directeur Général honoraire de la Société Nationale des Chemins de fer belges, professeur émérite de l'Université de Louvain; 27, rue de l'Aurore, Bruxelles.

SECRETARY'S OFFICE : 19, rue du Beau-Site, Brussels.

General Secretary : **P. Ghilain** (already named).

Assistant to the General Secretary : **R. Squilbin,**
Senior Engineer, Belgian National Railways.

NEW BOOKS AND PUBLICATIONS.

[385 (09 .3 (43)]

125 Jahre Deutsche Eisenbahnen. Sonderausgabe von « Eisenbahntechnische Rundschau » (*125th Anniversary of the German Railways. Special edition of « Eisenbahntechnische Rundschau »*). — One volume (8 1/4 × 11 1/2 in.) of 72 pages, with 100 figures, diagrams and tables. — 1961, Darmstadt, Carl Röhrig Verlag, Holzhofallee 33a. (Price : DM 5.—.)

In his introduction, the Minister of Communications, Dr. SEEBOHM recalls that the development of techniques of all sorts and the evolution of the general economy and method of life is due, to a very large extent, to the progress made by the railways since they were first created. Railway publications, amongst which mention must be made in particular of the E.T.R., have been a powerful factor in spreading a knowledge of the evolution of techniques throughout the world.

The President of the Deutsche Bundesbahn, Dr.-Ing. Hans GEITMANN then gives a remarkable review of the various technical developments realised by the D.B. during the last ten years.

After reviewing the work of rationalisation and modernisation undertaken since 1945, the first chapter is devoted to the most recent progress and realisations in the field of track installations, bridges, tunnels, signals and station buildings.

The following chapters deal in turn with :—

— recent types of traction and rolling stock;

— operating techniques;

— the goods traffic, and in particular the use of special wagons, containers, rail-road vehicles;

— the rationalisation of the shops;

— stores, and also the part played by the railway as a customer of industry;

— international collaboration;

— the international collaboration of the railways and their role within the framework of European economics.

W. v. R.

MONTHLY BIBLIOGRAPHY OF RAILWAYS[1]

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(AUGUST 1961)

[016 .385 (02]

I. — BOOKS.

In French.

1961 656
DURAND (P.).
La pratique des transports par fer-route-eau-air.
Paris, Editions J. Delmas. Un volume (21 × 27 cm) de 176 pages. (Prix : 21.80 NF avec mises à jour.)

1961 625 .42
HARBOUR (B.H.).
Commission des Métropolitains. Place des Métropolitains dans les transports publics urbains.
Rapport III du XXXIV[e] Congrès International (Copenhague, 1961) de l'Union Internationale des Transports Publics.
Bruxelles, Union Internationale des Transports Publics, 18, avenue de la Toison d'Or. Une brochure (21.5 × 27 cm) de 46 pages, illustrée.

1961 625 .6
Dr.-Ing. F. LEHNER.
Commission de la circulation. Le rôle des transports publics dans le cadre du plan général de la circulation urbaine.
Rapport I du XXXIV[e] Congrès International (Copenhague, 1961), de l'Union Internationale des Transports Publcs.
Bruxelles, Union Internationale des Transports Publics, 18, avenue de la Toison d'Or. Une brochure (21.5 × 27 cm) de 85 pages, illustrée.

1961 621 .3
MROSS (M.).
Commission de l'automation. b) L'utilisation de machines électroniques pour le traitement de l'information (data processing) en vue de l'établissement des horaires, des plans de service et de la recherche opérationnelle.
Rapport IV du XXXIV[e] Congrès International (Copenhague, 1961), de l'Union Internationale des Transports Publics.
Bruxelles, Union Internationale des Transports Publics, 18, avenue de la Toison d'Or. Une brochure (21.5 × 27 cm) de 13 pages avec figures.

1961 656 .23
ROBBINS (R.M.) & POSTGATE (R.).
Tarifs. Etude des aspects économiques des différentes structures tarifaires.
Rapport VII du XXXIV[e] Congrès International (Copenhague, 1961) de l'Union Internationale des Transports Publics.
Bruxelles, Union Internationale des Transports Publics, 18, avenue de la Toison d'Or. Une brochure (21.5 × 27 cm) de 22 pages avec annexe.

1961 62 (01
SALLES (F.).
Initiation à la théorie de l'énergie élastique.
Paris (6[e]), Dunod, éditeur, 92, rue Bonaparte. Un volume de 180 pages (16 × 25 cm), avec 246 figures. (Prix : 19 NF.)

1961 385 (08 (493)
SOCIÉTÉ NATIONALE DES CHEMINS DE FER VICINAUX.
Rapports présentés par le Conseil d'Administration et par le Comité de Surveillance. Soixante-seizième exercice social (1960).
Bruxelles, Imprimerie Graphica, 54, rue Auguste Lambiotte. Une brochure (22.5 × 30.5 cm) de 114 pages, avec de nombreux tableaux et illustrations.

In German.

1961 385 (09 .3 (43)
125 Jahre Deutsche Eisenbahnen. *Sonderausgabe der « Eisenbahntechnische Rundschau ».*
Darmstadt, Carl Röhrig Verlag, Holzhofallee 33 a. 72 Seiten Textteil DIN A 4 mit zalhreichen Abbildungen, Diagrammen und Übersichten. (Preis : DM 5.—.)

1961 624 .2
STAMPF (W.).
Der durchlaufende Bogenträger auf elastischen Stützen mit und ohne Versteifungsträger.
Berlin, Göttingen, Heidelberg, Springer-Verlag, 146 Seiten (15.5 × 23 cm) mit 206 Bildern und 2 Tafeln. (Preis : DM 37.50.)

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels, (See « Bibliographical Decimal Classification as applied to Railway Science », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1961 **656 .222 .5 (4)**

Dr. Fritz STÖCKL.

Europäische Eisenbahnzüge mit klangvollen Namen.

Darmstadt, Carl Röhrig Verlag, Holzhofallee 33. 336 Seiten (16 × 23.8 cm) mit 68, zum Teil mehrfarbigen Bildseiten. (Preis : Ganzleinen, DM 28.— Eisenbahner-Vorzugspreis : DM 19.60.)

1961 **385 (03**

STUMPF (B.).

Eisenbahn-Lexikon. 4 000 Stichwörter aus allen Fachgebieten des Eisenbahnwesens. Band 5.

Mainz und Heidelberg, Verlagsanstalt Hüthig und Dreyer GmbH. XIV + 218 Seiten. (Preis : DM 15.—.)

In English.

1961 **621 .132 .1 (09 (42)**

AHRONS (E.L.).

The British Steam Railway Locomotive, 1825-1925.

One volume (11 1/2×8 1/2 in.) of 391 pages, illustrated.

Hampton Court, Surrey : Locomotive Publishing Co. Ltd., Craven House. (Price : 45 s.)

1961 **385 .3 (08**

Annual Report 1960. East African Railways & H bours.

A brochure of 64 pages, illustrated.

Published by the General Manager, East African Ra ways and Harbours, Nairobi, Kenya (Price : 5 s.)

1961

HAY (W.W.).

An introduction to transportation engineering.

One volume (6 ×9 1/4 in.) of 505 pages, illustrat

London: Bookservice, 51, The Mall, Ealing, W (Price : 96 s.)

1961 **621 .132 .1 (**

EVANS (M.).

Pacific Steam : The British Pacific locomotive.

London : Percival Marshall and Co., Ltd., 19- Noel Street, W. 1. (Price : 12 s. 6 d.)

[**016** .385 (05]

II. — PERIODICALS.

In French.

Acier - Stahl - Steel. (Bruxelles.)

1961 **624 .2**

Acier - Stahl - Steel, juin, p. 281.

GOSCHY (B.). — **Autovibrations des ponts tubes à haubans.** (2 000 mots & fig.)

1961 **621 .392**

Acier - Stahl - Steel, juin, p. 287.

ODONE (G.), MILANESE (G.) et PORTA (A.). — Recherches sur la **soudure des tôles d'acier galvanisées.** (3 000 mots, tableaux & fig.)

1961 **691**

Acier - Stahl - Steel, juin, p. 297.

Protection des constructions métalliques contre la corrosion. (3 200 mots, tableaux & fig.)

Annales de l'Institut Technique du Bâtiment et des Travaux Publics. (Paris.)

1961 **624 & 691**

Annales de l'Institut Techn. du Bâtiment et des Trav. Publics, mai, p. 453.

BARETS (J.). — **Pont-canal en béton précontraint** de Saint-Gilles. (8 000 mots, tableaux & fig.)

1961 **69**

Annales de l'Institut Techn. du Bâtiment et des Trav. Publics, mai, p. 541.

ADAM. — **Emploi des panneaux de fibres de bois comme coffrage.** (5 000 mots, tableaux & fig.)

Annales des Ponts et Chaussées. (Paris.)

1961 **62 (**

Annales des Ponts et Chaussées, mai-juin, p. 293.

DAVIN. — Quelques problèmes de **flambement d dalles en béton reposant sur le sol.** (20 000 mots, tablea & fig.)

Annales des Travaux Publics de Belgique. (Bruxelles.)

1960, 61 **6**

Annales des Travaux Publics de Belgique, n° 6, décembr p. 515.

de GRAVE (A.). — L'utilisation des huiles combus bles. Notions sur les **combustibles liquides.** (20 000 mo tableaux & fig.)

Bulletin de l'Association Suisse des Electriciens. (Zürich.)

1961 **621 .3**

Bull. de l'Ass. Suisse des Electriciens, 3 juin, p. 401.

REY (E.) et ERHART (L.). — **Die Beurteilung v inhibitierten und nichtinhibitierten Isolierölen für Hoc spannungs-Transformatoren und Messwandler.** (8 000 mo & fig.)

1961 **621**

Bull de l'Ass. Suisse des Electriciens, 3 juin, p. 413.

ENGDAHL (J.). — **Calcul rapide de circuits à tra sistors à l'aide des paramètres h.** (2 000 mots & fig.)

Bulletin de Documentation S.C.E.T.A. (Paris.)

1961 **656** .225 (73)
Bull. de Documentation S.C.E.T.A., juin, p. 1.
Transports piggyback : modalités d'échange du matériel pour les transports intéressant plusieurs réseaux américains. (1 200 mots & tableaux.)

Bulletin scientifique de l'Association des Ingénieurs électriciens sortis de l'Institut Electrotechnique Montefiore. (Liège.)

1961 **621** .316
Bull. scient. de l'Assoc. des Ing. électr. sortis de l'Institut Electrotechnique Montefiore, février, p. 73.
GOLDSTEIN (H.). — L'ingénieur devant les **problèmes de la protection cathodique.** (3 500 mots.)

1961 **621** .316
Bull. scient. de l'Assoc. des Ing. électr. sortis de l'Institut Electrotechnique Montefiore, février, p. 84.
NOIROUX (G.). — **Etat actuel de la protection cathodique.** (4 700 mots & fig.)

Bulletin des Transports Internationaux par Chemins de fer. (Berne.)

1961 **656** .24 (437)
Bull. des Transp. Intern. par Ch. de fer, mai, p. 124.
ZAVISKA (Z.). — La **procédure de réclamation dans le trafic interne des marchandises** des Chemins de fer tchécoslovaques de l'Etat. (*A suivre.*) (2 000 mots.)

Bulletin de l'Union Internationale des Chemins de fer. (Paris.)

1961 **656** .23 (4)
Bull. de l'Union Intern. des Chemins de fer, avril, p. 119.
Le **trafic ferroviaire en Europe Occidentale** au cours de l'année 1960. (1 100 mots & fig.)

1961 **385** .113 (4 + 6)
Bull. de l'Union Intern. des Chemins de fer, avril, p. 125.
Les **Chemins de fer en 1960.** (Algérie, Congo, Finlande, Pays-Bas.) (3 000 mots & tableaux.)

1961 **385** .113 (73)
Bull. de l'Union Intern. des Chemins de fer, avril, p. 133.
GETTY (G.E.). — Les **Chemins de fer des Etats-Unis d'Amérique en 1960.** (2 000 mots & tableaux.)

1961 **656** .222 .6
Bull. de l'Union Intern. des Chemins de fer, mai, p. 159.
Une réalisation pour l'acheminement rapide des marchandises : le TEEM. (2 000 mots & fig.)

1961 **385** .113 (4 + 6)
Bull. de l'Union Intern. des Chemins de fer, mai, p. 168.
Les Chemins de fer en 1960. (Allemagne, Autriche, Danemark, Espagne, Maroc.) (10 000 mots & tableaux.)

C.F.F. (Berne.)

1961 **385** .113 (494)
C.F.F., juin, p. 3.
Les Chemins de fer fédéraux en 1960. (1 500 mots.)

1961 **625** .2 (494)
C.F.F., juin, p. 6.
Les trains légers circulent depuis 25 ans. (1 000 mots & fig.)

1961 **656** .222 .5 (4)
C.F.F., juin, p. 10.
Nouveaux Trans-Europ-Express électriques. (1 000 mots & fig.)

Le Génie Civil. (Paris.)

1961 **669**
Le Génie Civil, n° 3540, 15 mai, p. 231.
Les recouvrements métalliques et réfractaires. (*Suite.*) (2 000 mots & fig.)

1961 **691**
Le Génie Civil, n° 3540, 15 mai, p. 235.
COÜARD (A.). — **Remarques sur le nouveau règlement du béton armé 1960.** (1 500 mots & fig.)

1961 **669**
Le Génie Civil, n° 3541, 1er juin, p. 258.
Les recouvrements métalliques et réfractaires. (*Suite.*) (1 500 mots & fig.)

Rail et Traction. (Bruxelles.)

1961 **656** .2 (493)
Rail et Traction, janvier-février, p. 5.
GUILLAUME (H.F.). — **La modernisation de la S.N.C.B.** (1 500 mots & fig.)

1961 **656** .2 (481)
Rail et Traction, janvier-février, p. 9.
VAN GEEL (P.). — Les **Chemins de fer Norvégiens de l'Etat.** (*A suivre.*) (3 000 mots & fig.)

Revue Générale des Chemins de fer. (Paris.)

1961 **625** .144 (44)
Revue Générale des Chemins de fer, juin, p. 325.
BOUILLON (R.). — **Un engin moderne pour la pose ou la dépose de travures pour voies ferrées.** (2 500 mots & fig.)

1961 **656** .213 (44)
Revue Générale des Chemins de fer, juin, p. 333.
CHARLES (J.). — Les **travaux d'extension de Dunkerque.** (3 000 mots & fig.)

1961 **625** .143 .4 (44)
Revue Générale des Chemins de fer, juin, p. 343.
CHOLLET. — Le **soudage des rails** à la S.N.C.F. (3 300 mots & fig.)

1961 **625** .143 .4 (44)
Revue Générale des Chemins de fer, juin, p. 351.
FORESTIER et FOSSIEZ. — La **machine à souder les rails en service** sur la chaîne de fabrication de barres longues à l'Atelier-Magasin du Moulin-Neuf. (Région du Nord). (2 200 mots & fig.)

1961 **656** .223 .2 (44)
Revue Générale des Chemins de fer, juin, p. 357.
LIÉNART et PLANTUREUX. — Détermination par sondage des éléments de la **durée de rotation des wagons.** Méthode utilisée par la S.N.C.F. en 1958. (3 000 mots & fig.)

1961 **625** .245 (44)
Revue Générale des Chemins de fer, juin, p. 364.
Le **wagon deux ponts TA 60** pour le transport d'automobiles. (1 000 mots & fig.)

1961 **656** .222 .6 (4)
Revue Générale des Chemins de fer, juin, p. 369.
Le réseau international de trains de marchandises « **Trans-Europ-Express-Marchandises** » (TEEM). (1 000 mots & tableau.)

Revue Générale de Mécanique-Electricité. (Paris.)

1961 **621** .314
Revue Générale de Mécanique-Electricité, n° 143, avril, p. 61.
ENAULT (Y.). — **Protection et entretien rationnels des transformateurs.** (5 300 mots & fig.)

1961 **621** .315
Revue Générale de Mécanique-Electricité, n° 143, avril, p. 70.
OUDIN (J.M.). — **Câbles à courant continu.** (3 700 mots & fig.)

Revue de l'Union Internationale des Transports Publics. (Bruxelles.)

1961 **656** .2 (489)
Revue de l'Union Intern. des Transp. Publics, n° 1, avril, p. 57.
The Danish State Railways, the Ferry Services and the Copenhagen Urban and Suburban Traffic. (5 000 mots, tableaux & fig.)

La Technique Moderne. (Paris.)

1961 **621** .31 (06
La Technique Moderne, mai, p. 174.
Conférence Internationale des Grands Réseaux Electriques (*Suite.*) **Alternateurs,** par G. RUELLE. (700 mots.) **Isolateurs,** par L. GION. (800 mots & fig.)

1961 **621** .31
La Technique Moderne, mai, p. 188.
Alternateurs à haute tension sans excitatrice. (600 mots & fig.)

1961 **621** .
La Technique Moderne, mai, p. 196.
Centrales thermiques mobiles. (600 mots & fig.)

La Traction Electrique dans les Chemins de fe (Bruxelles.)

1961 **621** .338 (7
Bulletin du Congrès des Chemins de fer. — La Tractio Electrique dans les Chemins de fer, n° 4, avril, p. 15
MANSER (A.W.). — Trois trains d'un type nouvea pour le London Transport. (3 600 mots & fig.)

1961 **621** .
Bulletin du Congrès des Chemins de fer. — La Tractio Electrique dans les Chemins de fer, n° 4, avril, p. 17
READ (J.C.). — **Redresseurs de courant au germaniu et au silicium.** Etat actuel des progrès dans le mond (3 500 mots & fig.)

1961 **621** .43
Bulletin du Congrès des Chemins de fer. — La Tractio Electrique dans les Chemins de fer, n° 4, avril, p. 18
TENGER (L.H.). — **Locomotive à générateur de ga** à pistons attelés. (3 400 mots & fig.)

1961 **621** .335 (42
Bulletin du Congrès des Chemins de fer· — La Tractio Electrique dans les Chemins de fer, n° 4, avril, p. 19
Locomotives à courant alternatif haute tension de British Railways. (1 300 mots & fig.)

1961 **621** .431 .72 (6
Bulletin du Congrès des Chemins de fer. — La Tractio Electrique dans les Chemins de fer, n° 4, avril, p. 20
Locomotives Diesel-électriques pour l'Afrique Orientale (1 400 mots & fig.)

Les Transports Publics. (Berne.)

1961 **625** .13 (494
Les Transports Publics, mai, p. 4.
Il y a cinquante ans ... Le tunnel du Loetschberg étai percé. (1 000 mots & fig.)

La Vie du Rail. (Paris.)

1961 **625** .236 (42
La Vie du Rail, 14 mai, p. 7.
Lavage automatique des trains à Upminster. (Londor Transport). (500 mots & fig.)

1961 **656** .222 .1 (44
La Vie du Rail, 28 mai, p. 10.
GUILLIER (A.). — **En courant monophasé 50 Hz 2733 t en rampe de 10** ‰. Récente performance de la BB 20104 à bogies monomoteur. (600 mots & fig.)

1961 **656** .21 (44
La Vie du Rail, 4 juin, p. 16.
Nancy, carrefour ferroviaire. (2 000 mots & fig.)

1961 **621 .335 (44)**
La Vie du Rail, 11 juin, p. 6.
Sous caténaire monophasée 25 kV-50 Hz, **la BB-20103 circule à 190 km/h.** (1 000 mots & fig.)

1961 **656 .222 .6 (44)**
La Vie du Rail, 11 juin, p. 13.
TROUILLAS (M.). — **Le Provence Express.** (500 mots & fig.)

1961 **625 .62 (494)**
La Vie du Rail, 11 juin, p. 16.
ROBERT (J.). — **Le nouveau matériel** des Tramways de Zürich. (1 500 mots & fig.)

In German.

Die Bundesbahn. (Darmstadt.)

1961 **385 .1 (43)**
Die Bundesbahn, Nr. 7/8, April, S. 307.
OEFTERING (H.M.). — **Fortschritte in der wirtschaftlichen Situation** der Deutschen Bundesbahn unverkennbar. (6 000 Wörter.)

1961 **625 .26 (43)**
Die Bundesbahn, Nr. 7/8, April, S. 318.
BRÜGGEMANN (J.). — **Die Walzstahlbeschaffung für die Fahrzeugausbesserung** der Deutschen Bundesbahn. (6 000 Wörter.)

1961 **656 .222 .5**
Die Bundesbahn, Nr. 7/8, April, S. 327.
KREIDLER (E.). — **Der überlagerte Fahrplan-** Ein Beitrag zur Problematik der individuellen Verkehrsbedienung, Fahrplanbearbeitung und Betriebsabwicklung. (2 400 Wörter, Tabellen & Abb.)

1961 **656 .214**
Die Bundesbahn, Nr. 7/8, April, S. 333.
FÜLLING (F.). — **Probleme grenzüberschreitenden Eisenbahngüterverkehrs.** (2 000 Wörter & Abb.)

1961 **656 .212 .7**
Die Bundesbahn, Nr. 7/8, April, S. 342.
SCHERSCHMIDT (G.). — Eine rationelle **Förderanlage für Frachtbriefe.** (1 500 Wörter & Abb.)

1961 **614 .8**
Die Bundesbahn, Nr. 7/8, April, S. 350.
HEGENBARTH (F.). — Neues zum alten Thema **Brandschutz.** (5 000 Wörter, Tafel & Abb.)

1961 **656 .222 .5 (43)**
Die Bundesbahn, Nr. 9, Mai, S. 384.
ZILLER (H.). — **Neuerungen und Verbesserungen im Güterverkehr der Deutschen Bundesbahn** zum Jahresfahrplan 1961/62, gültig ab 28. Mai 1961. (5 000 Wörter, Tafeln & Abb.)

1961 **656 (43)**
Die Bundesbahn, Nr. 9, Mai, S. 394.
HEINZE (W.). — **Die Genehmigungsvoraussetzungen nach dem neuen Personenbeförderungsgesetz.** (5 000 Wörter.)

1961 **656 .1 (43)**
Die Bundesbahn, Nr. 9, Mai, S. 402.
THOMA (A.). — **D B unentbehrlich für termingerechten Autobahnbau.** (1 700 Wörter & Abb.)

Der Eisenbahningenieur. (Frankfurt am Main.)

1961 **625 .143 .3**
Der Eisenbahningenieur, Mai, S. 131.
VÖLKER (A.). — **Aufarbeiten von Altschienen mit der Schienenkopfhobelmaschine.** (2 000 Wörter & Abb.)

1961 **624**
Der Eisenbahningenieur, Mai, S. 135.
BARGMANN (M.). — **Elektronische Berechnung eines Kreuzungsbauwerkes.** (3 000 Wörter & Abb.)

1961 **625 .162**
Der Eisenbahningenieur, Mai, S. 140.
DECKER (F.). — **Fahrbahnbeläge auf Bahnübergängen.** (1 200 Wörter & Abb.)

1961 **657**
Der Eisenbahningenieur, Mai, S. 142.
SUTTER (W.). — Das **industrielle Rechnungswesen** — seine Bedeutung für den Ingenieur in Verkehrsunternehmen. (5 000 Wörter.)

1961 **625 .151**
Der Eisenbahningenieur, Mai, S. 147.
BÖSE (E.). — Fahrdynamische Betrachtungen zur **Ermittlung günstiger Krümmungsverhältnisse in Bogenweichenverbindungen.** (5 000 Wörter & Abb.)

Deutsche Eisenbahntechnik. (Berlin.)

1961 **656**
Deutsche Eisenbahntechnik, Mai, S. 193.
FLEISCHER (H.). — Die nächsten Aufgaben der **Forschung und Entwicklung im Verkehrswesen.** (3 000 Wörter.)

1961 **385 (07**
Deutsche Eisenbahntechnik, Mai, S. 198.
MÜLLER (H.). — Über einige wissenschaftliche Arbeitsmethoden in der **Standardisierung.** (6 000 Wörter & Abb.)

1961 **625 .2**
Deutsche Eisenbahntechnik, Mai, S. 207.
HEROLD (G.). — Die **Standardisierung im Neubau von Schienenfahrzeugen** unter Berücksichtigung der Erhaltung und des Austauschbaues. (3 500 Wörter.)

1961 **625 .2 (4)**
Deutsche Eisenbahntechnik, Mai, S. 218.
PRUSSAK (H.). — **Schienenfahrzeuge** auf der Leipziger Messe 1961. (2 000 Wörter, Tafeln & Abb.)

1961 **625 .245**
Deutsche Eisenbahntechnik, Mai, S. 223.
Der **neue zweiachsige Behältertragwagen** der Deutschen Reichsbahn. (1 500 Wörter & Abb.)

1961 **621 .82**
Deutsche Eisenbahntechnik, Mai, S. 225.
ZEILER (H.). — **Lagerprüfstandsversuche mit Plaste-Tatzenlager der Berliner S-Bahn.** (5 000 Wörter & Abb.)

Elektrische Bahnen. (München.)

1961 **621 .335 (43)**
Elektrische Bahnen, Heft 4, S. 69.
MARTEN (F.). — **Die elektrische Ausrüstung der Mehrsystemlokomotive E 320.21 der Deutschen Bundesbahn.** (5 200 Wörter & Bilder.)

1961 **621 .314**
Elektrische Bahnen, Heft 4, S. 77.
JANETSCHKE (E.). — **Silizium-Gleichrichter in Schnellbahnunterwerken.** (6 100 Wörter & Bilder.)

Elektrotechnik und Maschinenbau. (Wien.)

1961 **621 .31**
Elektrotechnik und Maschinenbau, 1. Mai, S. 306.
SCHÖFFEL (F.). — **Elektroschutz bei Arbeiten an Hochspannungsanlagen.** (4 600 Wörter & Bilder.)

1961 **621 .31**
Elektrotechnik und Maschinenbau, 1. Mai, S. 311.
Die Problematik des Elektroschutzes bei ortsveränderlichen Elektrogeräten. (4 100 Wörter & Bild.)

1961 **621 .31**
Elektrotechnik und Maschinenbau, 1. Mai, S. 316.
AMON (G.) & HAVRAN (L.). — **Hochempfindliche Fehlerstromschutzschalter in der Praxis.** (3 400 Wörter & Bild.)

1961 **621 .31**
Elektrotechnik und Maschinenbau, 1. Mai, S. 321.
BIEGELMEIER (G.). — Eine neue Demonstrationsanlage für **Schutzmassnahmen in Niederspannungsanlagen.** (4 700 Wörter & Bild.)

1961 **621 .31**
Elektrotechnik und Maschinenbau, 1. Mai, S. 329.
MARESCH (F.). — **Elektrizitätsspuren an Metallen.** (3 100 Wörter & Abb.)

1961 **621 .31**
Elektrotechnik und Maschinenbau, 1. Mai, S. 352.
REICHE (W.). — Über die **Kurzschlusspannung von Transformatoren** in Kaskadeschaltung. (2 750 Wörter & Abb.)

E.T.Z. — Elektrotechnische Zeitschrift. (Berl

1961 **62**
E.T.Z. Elektrotechnische Zeitschrift, 15. Mai, S. 2
BAECKMANN (W. G.v.). — **Grundlagen des kat dischen Schutzes.** (5 000 Wörter & Bild.)

1961 **621**
E.T.Z. Elektrotechnische Zeitschrift, 15. Mai, S. 2
BINDER (K.). — **Der Einfluss mechanischer Eig schwingungen von Kohlenbürsten auf Kommutierung Stromabnahme.** (2 700 Wörter & Bild.)

1961 **621 .**
E.T.Z. Elektrotechnische Zeitschrift, 29. Mai, S. 2
REY (E.). — **Einfaches Nachweisverfahren von Inh toren und anderen wichtigen Bestandteilen in Isolieröl** (4 300 Wörter & Bild.)

E.T.R.-Eisenbahntechnische Rundschau. (Darmstadt.)

1961 **625 .3 (4) & 656 .2**
Eisenbahntechnische Rundschau, Mai, S. 181.
EISENMANN (J.). — **Alpenbahnen.** (5 000 Wört Tafel & Abb.)

1961 **656 .25 (**
Eisenbahntechnische Rundschau, Mai, S. 190.
SASSE (H.-W.). — Zur Entwicklung der **Signaltechn in Deutschland.** (8 000 Wörter & Abb.)

1961 **625 .172 (**
Eisenbahntechnische Rundschau, Mai, S. 204.
LÖFLUND (E.). — **Entwurfsgrundlagen für den neu Gleismesswagen der D.B.** (7 000 Wörter & Abb.)

1961 **656 .2**
Eisenbahntechnische Rundschau, Mai, S. 218.
LEITENBERGER (W.). — **Die heutige Fernm detechnik im Dienst der Eisenbahnen.** (5 000 Wörter Abb.)

1961 **656 .25 (**
Eisenbahntechnische Rundschau, Mai, S. 227.
Modernes Signalwesen bei den Britischen Bahne (2 500 Wörter & Abb.)

Europa Verkehr. (Darmstadt.)

1961 **347 .763 .4 (**
Europa Verkehr, Heft 1, S. 3.
OEFTERING (H.M.). — **Zur Revision des Bunde bahngesetzes.** (1 500 Wörter.)

1961 **624 (43 + 48**
Europa Verkehr, Heft 1, S. 4.
JAHNKE (Th.). — Das Bauprojekt **Fehmarnsun brücke.** (5 000 Wörter & Abb.)

1961 **621** .33 (42)
Europa Verkehr, Heft 1, S. 22.
HOPKINS (C.P.). — Southern Region of British Railways — **Extensions of electrified traction in Kent.** (2 500 Wörter & Abb.)

1961 **621** .335 (43 + 44)
Europa Verkehr, Heft 1, S. 28.
GLADIGAU (A.). — Die **deutschen und französischen Mehrsystemlokomotiven.** (3 000 Wörter, Tabellen & Abb.)

Internationales Archiv für Verkehrswesen. (Frankfurt am Main.)

1961 **656**
Intern. Archiv für Verkehrswesen, Mai, S. 155.
STORSBERG (G.). — **Grundsätze zur Verkehrspolitik.** (5 000 Wörter.)

1961 **625** .1 (43)
Intern. Archiv für Verkehrswesen, Mai, S. 167 .
KÜNZEL (K.). — **Wirtschaftliche Planung bei Bauarbeiten der Deutschen Bundesbahn.** Gezeigt am Beispiel der Umbauten in Mannheim. (3 000 Wörter & Abb.)

Der Öffentliche Verkehr. (Bern.)

1961 **625** .6 (494)
Der Öffentliche Verkehr, Mai, S. 5.
Eine Gedenkfeier der Lötschbergbahn - und ein Blick in die Zukunft. (1 500 Wörter & Abb.)

1961 **388**
Der Öffentliche Verkehr, Juni, S. 7.
MIESCHER (O.). — **Der Innerortsverkehr in Vergangenheit und Zukunft.** (2 000 Wörter & Abb.)

1961 **656** .222 .5 (4)
Der Öffentliche Verkehr, Juni, S. 10.
Neue elektrische TEE-Züge. (1 000 Wörter & Abb.)

Signal und Draht. (Frankfurt am Main.)

1961 **656** .254
Signal und Draht, Mai, S. 65.
LEITENBERGER (W). — **Die Elektronik in Fernsprechwählanlagen.** (1 200 Wörter & Abb.)

1961 **656** .25 (43 + 44)
Signal und Draht, Mai, S. 67.
STEINFELD (H.). — Die **Signalanlagen des deutsch-französischen Gemeinschaftsbahnhofes Überherrn.** (3 000 Wörter & Abb.)

Wissenschaftliche Zeitschrift der Hochschule für Verkehrswesen Dresden. (Dresden.)

1960/61 **625** .251
Wissenschaftliche Zeitschrift der Hochschule für Verkehrswesen Dresden, Heft 1, S. 67.
KURZ (H.). — **Die Ermittlung des Zeitzuschlages für das Bremsen in zwei Abschnitten.** (1 300 Wörter, Tafel & Abb.)

1960/61 **625** .214 (43)
Wissenschaftliche Zeitschrift der Hochschule für Verkehrswesen Dresden, Heft 1, S. 71.
JENTSCH (O.) und WÄCHTER (K.). — **Ölmengenmessung an Regelpolstern von Wagengleitachslagern** der Deutschen Reichsbahn. (Teil 1.) (6 000 Wörter, Tabellen & Abb.)

1960/61 **625** .212
Wissenschaftliche Zeitschrift der Hochschule für Verkehrswesen Dresden, Heft 1, S. 85.
SCHIMMING (H.). — Zu einigen Problemen der **Radsatz-Umrissbearbeitung.** (Teil II.) (10 000 Wörter & Abb.)

1960/61 **721** .1
Wissenschaftliche Zeitschrift der Hochschule für Verkehrswesen Dresden, Heft 1, S. 115.
KEIL (K.). — **Frostsichere und frostfreie Gründung.** (4 000 Wörter & Abb.)

In English.

Association of American Railroads. (Chicago.)

1961 **656** .25 (73)
Association of American Railroads.
American Railway Signaling Principles and Practices, *Chapter XXVI* : **Relay interlocking.** (40 pages of text, plus diagrams.)

Electric Traction on the Railways. (Brussels.)

1961 **621** .335
Bulletin of the International Railway Congress Association — Electric Traction on the Railways, No. 4, April, p. 155.
HILSENBECK (K.). — Innovation in the **electrical equipment** of a **dual-frequency multi-voltage locomotive.** (5 950 words & fig.)

1961 **621** .332
Bulletin of the International Railway Congress Association — Electric Traction on the Railways, No. 4, April, p. 170.
HAUSMANN (L.). — **Overhead contact line** and **pantograph.** (8 000 words & fig.)

1961 **621** .431 .72 (47)
Bulletin of the International Railway Congress Association — Electric Traction on the Railways, No. 4, April, p. 194.
BÜTTNER (S.). — Heavy **Diesel-hydraulic** shunting **engines** for the U.S.S.R. (1 100 words & fig.)

1961 **621** .338 (52)
Bulletin of the International Railway Congress Association — Electric Traction on the Railways, No. 4, April, p. 200.
Japanese National Railways study A.C. **electric railcar** designs. (1 000 words & fig.)

The Engineer. (London.)

1961 **625** .24 (42)
The Engineer, May 19, p. 831.
Experimental goods wagon. (300 words & figs.)

1961 **656** .2 (42)
The Engineer, June 16, p. 986.
Can British Railways pay ? (1 400 words.)

Hungarian Heavy Industries. (Budapest.)

1961 **625** .285
Hungarian Heavy Industries, Spring, p. 23.
Air resistance of railcar trains. (3 000 words & figs.)

Indian Railways. (New Delhi.)

1961 **625** .162 (42)
Indian Railways, May, p. 305.
TOWERS (H.C.). — **British Railways go with lifting barrier gates.** (1 400 words & figs.)

Proceedings, The Institution of Civil Engineers. (London.)

1961 **625** .28 (42)
Proceedings, The Institution of Civil Engineers, April, p. 345.
HARRISON (J.F.). — **The impact of mechanical engineering on the British Railways modernization plan.** (16 pages, illustrated.)

1961 **621** .33 (42)
Proceedings, The Institution of Civil Engineers, April, p. 361.
WARDER (S.B.). — **Electric traction in the British Railways modernization plan.** (20 pages, illustrated.)

1961 **656** .25 (42)
Proceedings, The Institution of Civil Engineers, April, p. 381.
TYLER (J.F.H.). — **British Railways modernization — signal engineering and telecommunications.** (20 pages, illustrated.)

International Railway Journal. (The Hagu

1961 **625** .13 (
International Railway Journal, April, p. 40.
Britain : LTE uses new tunnel borer. (1 000 words figs.)

1961 **625** .245 (
International Railway Journal, April, p. 44.
US studies new cars. (700 words & figs.)

1961 **621** .431 .72 (4
International Railway Journal, May, p. 16.
The « Taurus » multi-purpose locomotive. (600 wor tables & figs.)

1961 **625** .1
International Railway Journal, May, p. 19.
Elst : Permanent-way showcase. (1 000 words & fig

1961 **621** .335 (7
International Railway Journal, May, p. 25.
US progress in electric motive-power. (900 words & fig

Japanese Railway Engineering. (Tokyo.)

1961 **625** .233 (5
Japanese Railway Engineering, March, p. 18.
Fluorescent illumination of passenger cars. (1 000 wor & figs.)

1961 **656** .25 (5
Japanese Railway Engineering, March, p. 22.
JIRO TSUZUKI. — **Newly developed techniques remote control of substations.** (2 400 words & figs.)

1961 **625** .241 (5
Japanese Railway Engineering, March, p. 29.
Hopper car for spreading ballast. (400 words & figs

1961 **625** .143 .5 (5
Japanese Railway Engineering, March, p. 30.
HANKICHI UZUKA. — **Elastic rail fastenings.** (40 words & figs.)

1961 **656** .25 (5
Japanese Railway Engineering, March, p. 33.
HAJIME KAWANABE. — **Automatic train contr system.** (1 800 words & figs.)

Modern Transport. (London.)

1961 **656** .2 (42
Modern Transport, April 8, p. 7.
HAWKINS (L.C.). — **Future of mass transport.** (2 00 words.)

1961 **625** .172 (42
Modern Transport, April, 15, p. 5.
Railway weed killing. (600 words & figs.)

1961 **656** .212 (42)
Modern Transport, April 22, p. 7.
Unusual parcel conveyor. (600 words & figs.)

1961 **656** .2 (42)
Modern Transport, April 29, p. 3.
Modernization in the North Eastern Region. (1 500 words & figs.)

1961 **656** .2 (42)
Modern Transport, April, p. 5.
INGLIS (C.C.). — **B.T.C. Research projects.** (2 000 words.)

1961 **621** .33 (42)
Modern Transport, April 29, p. 9.
S.R. electrification. (1 800 words & figs.)

1961 **621** .431 .72 (42)
Modern Transport, April 29, p. 15.
Twin-engined Diesel-hydraulic locomotive. (1 500 words & figs.)

1961 **656** .2 (42)
Modern Transport, April 29, p. 19.
Scottish progress : Extensive use of diesel traction. (1 200 words & figs.)

1961 **621** .33 (42)
Modern Transport, April 29, p. 21·
Live line from Lancashire to London. (1 500 words & figs.)

1961 **656** .25 (42)
Modern Transport, May 13, p. 5.
TYLER (J.F.H.). — **British Railways modernisation. Signalling and telecommunications** (2 400 words & figs.)

1961 **656** .2
Modern Transport, May 13, p. 17.
Shaping railways to the future. Sir Brian Robertson's review. (3 000 words.)

The Overseas Engineer. (London.)

1961 **656** .25
The Overseas Engineer, February, p. 22.
Electronic railway-signal interlocking. (800 words & figs.)

1961 **621** .431 .72 (42)
The Overseas Engineer, June, p. 354.
Dual purpose diesel-hydraulic locomotive. (500 words & figs.)

Railway Engineering. (Cape Town.)

1961 **625** .215 (68)
Railway Engineering, March, p. 26.
South African bogie manufacturers find local and export markets. (500 words & figs.)

The Railway Gazette. (London.)

1961 **656** .25 (42)
The Railway Gazette, April 28, p. 476.
Re-signalling of the Crewe-Liverpool section L.M. region of British Railways. (2 000 words & figs.)

1961 **656** .2 (42)
The Railway Gazette, May 5, p. 503.
BOND (R.C.). — **Railway modernisation conference.** (900 words.)

1961 **621** .33 (42)
The Railway Gazette, May 5, p. 504.
WARDER (S.B.). — **Electric traction.** (900 words.)

1961 **62** (42)
The Railway Gazette, May 5, p. 505.
HARRISON (J.F.). — **Mechanical engineering.** (800 words.)

1961 **656** .25 (42)
The Railway Gazette, May 5, p. 506.
TYLER (J.F.H.). — **Signals and telecommunications.** (900 words.)

1961 **625** (42)
The Railway Gazette, May 5, p. 507.
SMITH (M.G.R.). — **Civil engineering.** (600 words & figs.)

1961 **621** .33 (42)
The Railway Gazette, May 5, p. 510.
CALVERLEY (H.B.) and GRAHAM (G.W.). — **Developments in the 50-cycle system of railway electrification.** (1 300 words & figs.)

1961 **621** .33 (42)
The Railway Gazette, May 5, p. 513.
Mobile test laboratory for 25-kV lines on British Railways. (900 words & figs.)

1961 **625** .172
The Railway Gazette, May 5, p. 517.
Weed killing train. (500 words & figs.)

Diesel Railway Traction. (London.)

1961 **621** .431 .72 (43)
Diesel Railway Traction, April, p. 131.
Diesel loco-tractors. (2 400 words & figs.)

1961 **621** .431 .72
Diesel Railway Traction, April, p. 135.
M.G.O. quick-running engines. (3 000 words, tables & figs.)

1961 **625** .174 (52)
Diesel Railway Traction, April, p. 152.
Japanese Diesel snow-plough. (1 600 words & figs.)

1961 **621** .431 .72
Diesel Railway Traction, April, p. 155.
ORE standard locomotives and engines. (600 words, tables & figs.)

1961 **621** .431 . 72 (47)
Diesel Railway Traction, April, p. 163.
Large Soviet passenger locomotive. (600 words & figs.)

Railway Locomotives and Cars. (New York.)

1961 **625** .24 (73)
Railway Locomotives and Cars, May, p. 20.
SP tests stainless covered hopper. (600 words & figs.)

1961 **625** .241 (73)
Railway Locomotives and Cars, May, p. 26.
300-ton flat car built by D & H. (500 words & figs.)

1961 **625** .24 (73)
Railway Locomotives and Cars, May, p. 34.
REA express testing container cars. (1 600 words & figs.)

Quarterly Report, Railway Technical Research Institute J.N.R. (Tokyo.)

1960 **621** .431 .72 (52)
Quarterly Report, Railway Technical Research Institute J.N.R., Vol. 1, No. 1, p. 4.
NAKAYAMA (Y.). — **Effect of finishing grade on the wear of Diesel engine cylinder wall.** (1 500 words & figs.)

1960 **621** .134 .1 (52)
Quarterly Report, Railway Technical Research Institute J.N.R., Vol. 1, No. 1, p. 9.
USAMI (Y.). — **Variable lead valve-gears.** (1 200 words & figs.)

1960 **621** .336 (52)
Quarterly Report, Railway Technical Research Institute J.N.R., Vol. 1, No. 1, p. 14.
HARA (T.). — **Temperature rise in trolley wire.** (2 200 words & figs.)

1960 **625** .24 (52)
Quarterly Report, Railway Technical Research Institute J.N.R., Vol. 1, No. 1, p. 31.
ONO (S.) and NISHIMURA (B.). — **Electrical weighing plant for freight-car inspection concerning axle-load and wheel-load unbalance.** (1 600 words & figs.)

1960 **625** .143 .5 (52)
Quarterly Report, Railway Technical Research Institute J.N.R., Vol. 1, No. 1, p. 37.
NIMENURA (Y.) and KIMOTO (T.). — **Test result on elastic rubber-pads for railway track.** (2 200 words, tables & figs.)

1960 **621** .335
Quarterly Report, Railway Technical Research Insti J.N.R., Vol. 1, No. 2, p. 18.
KOKUBU (K.). — **Investigations of carbon b troubles in the traction motor of electric cars.** (3 000 wo tables & figs.)

1960 **621** .336
Quarterly Report, Railway Technical Research Insti J.N.R., Vol. 1, No. 2, p. 29.
IWASE (M.). — **Current collection by the pantogr and its wear.** (1 100 words & figs.)

1960 **625** .142 .4
Quarterly Report, Railway Technical Research Insti J.N.R., Vol. 1, No. 2, p. 46.
MIURA (I.), IWASAKI (I.) and NOGUCHI (T.). **Tests on tentative post-tensioning prestressed conc sleeper.** (1 700 words, tables & figs.)

1960 **656** .25
Quarterly Report, Railway Technical Research Insti J.N.R., Vol. 1, No. 4, p. 40.
ISHIAI (M.). — **Train safety control system.** (2 words & figs.)

1960 **656** .212 .5
Quarterly Report, Railway Technical Research Insti J.N.R., Vol. 1, No. 4, p. 49.
SHINOHARA (T.) and MARUSHI (M.). — **Frei car handling cost on marshalling yards.** (4 200 words figs.)

Railway Steel Topics. (Sheffield.)

1961 **385** (09
Railway Steel Topics, Spring, p. 5.
WIJEYESEKERA (E.C.). — **A brief history of Ceylon Government Railway.** (1 200 words & figs.)

1961 **625** .14 (09
Railway Steel Topics, Spring, p. 12.
REES (J.). — **Rail developments on British Railwa** (4 500 words & figs.)

1961 **625** .4
Railway Steel Topics, Spring, p. 23.
CHALMERS KEARNEY (E.W.). — **The Kearn high speed railway.** (1 500 words & figs.)

In Spanish.

Boletin de la Comisión Permanente de Asociación del Congreso Panamericano Ferrocarriles. (Buenos Aires.)

1961 **656** .2
Bol. de la Com. Perman. de la Asociación del Congre Panameric. de Ferrocarriles, enero-febrero, p.
Situación de los Ferrocarriles del Estado Argenti (10 000 palabras.)

In Italian.

Giornale del Genio Civile. (Roma.)

1961 **624** (45)
Giornale del Genio Civile, aprile, p. 253.
CESTELLI GUIDI (C.). — Un **ponte sul Tevere** in Roma. (4 000 parole & fig.)

1961 **624**
Giornale del Genio Civile, aprile, p. 261.
RANDO (P.). — **Metodo generalizzato di calcolo per telai elastici** con risoluzione diretta dei sistemi di equazioni. (6 000 parole, tavole & fig.)

Ingegneria Ferroviaria. (Roma.)

1961 **624**
Ingegneria Ferroviaria, aprile, p. 295.
di BERARDINO (V.). — Una notevole semplificazione per i calcolatori : **il metodo di Hardy Cross con i soli momenti di terza.** (1 000 parole, tavole & fig.)

1961 **614** .8 (45)
Ingegneria Ferroviaria, aprile, p. 329.
FINZI (V.). — La funzione dei tecnici nella **campagna per la prevenzione degli infortuni sul lavoro** presso le Ferrovie dello Stato. (4 000 parole & tabelle.)

1961 **656** .235 (45)
Ingegneria Ferroviaria, aprile, p. 344.
TANCREDI (A.) & POLI (E.). — Le **nuove « Condizioni » per i trasporti delle cose** sulle F.S. (2 000 parole.)

Politica dei Trasporti. (Roma.)

1961 **656** (45)
Politica dei Trasporti, marzo, p. 108.
ROCCA (M.). — **Strade e ferrovie** : complementarietà e non alternativa. (5 000 parole.)

1961 **388**
Politica dei Trasporti, marzo, p. 128.
PATRASSI (A.). — **Rendimento e potenzialità dei moderni trasporti rapidi urbani.** (4 000 parole & fig.)

Trasporti Pubblici. (Roma.)

1960 **656** .1 (45)
Trasporti Pubblici, novembre-dicembre, p. 1422.
La creazione di autoservizi in sostituzione di linee ferroviarie. (4 000 parole.)

1960 **621** .33 (45)
Trasporti Pubblici, novembre-dicembre, p. 1547.
DARD (M.). — **Elettrificate le linee Pistoia-Lucca-Viareggio e Lucca-Pisa.** (1 500 parole & fig.)

1960 **625** .5
Trasporti Pubblici, novembre-dicembre, p. 1547.
ITALO (B.) & NELLO (C.). — **Esperienze sulla confezione dei terminali a testa fusa delle funi di acciaio.** (8 000 parole & fig.)

In Netherlands.

De Ingenieur. (Den Haag.)

1961 **656** .222 .5 (492)
De Ingenieur, nr 20, 19 mei, p. V 21 en nr 21, 26 mei, p. V 39.
Dienstregeling Nederlandsche Spoorwegen en aansluitend streekvervoer. I. **De herziene reizigerstreindienst van de Nederlandse Spoorwegen**, door W.J. de GRAAFF. II. Aansluitend streekvervoer, door A.H.H. ROBBÉ GROSKAMP. (7 000 woorden & fig.)

1961 **624** .2
De Ingenieur, nr 22, 2 juni, p. O 110.
LEKKERKERKER (J.G.). — **De insteekdiepte van een balk met cirkelvormige doorsnede in een elastische halfruimte.** (1 200 woorden & fig.)

Spoor- en Tramwegen. (Den Haag.)

1961 **656** .222 .5 (492)
Spoor- en Tramwegen, nr 10, 18 mei, p. 157.
DE GRAAFF (W.J.). — **Herziening van de reizigerstreindienst.** (4 000 woorden & fig.)

1961 **659**
Spoor- en Tramwegen, nr 10, 18 mei, p. 165.
HUPKES (G.). — **Reclame voor merkartikelen en voor spoorweggoederenvervoer.** (2 500 woorden & fig.)

1961 **656** .225
Spoor- en Tramwegen, nr 10, 18 mei, p. 169.
RAMEIJER (G.H.). — **Vervoer van scooters en bromfietsen per trein.** (1 500 woorden & fig.)

1961 **694**
Spoor- en Tramwegen, nr 11, 1 juni, p. 175.
HASSELMAN (D.C.). — Grondslagen van de herbouw en de modernisering van de **houtbereidingsinrichting.** (900 woorden & fig.)

1961 **694** (492)
Spoor- en Tramwegen, nr 11, 1 juni, p. 176.
MEERDINK VELDBOOM (H.J.) & GROENHUYSEN (F.J.). — De **houtsbereidingsinrichting** der N.S. te Dordrecht gemoderniseerd. (3 000 woorden & fig.)

1961 **625** .2 (73)
Spoor- en Tramwegen, nr 11, 1 juni, p. 183.
HUPKES (G.). — Over het **gebruik van spoorwegembleмen** in Noord-Amerika. (2 000 woorden & fig.)

1961 **656** .2 (73)
Spoor- en Tramwegen, nr 11, 1 juni, p. 188.
STUNNENBERG (J.). — **De spoorwegen en de verkeerspolitiek** in de U.S.A. (1 500 woorden.)

In Polish (= 491 .85).

Przeglad Kolejowy. (Varsovie.)

1960 **656** .212 .5 = 491 .85
Przeglad Kolejowy, janvier, p. 1.
GAJDA (B.). — L'automatisation des fonctions préparatoires de **triage des wagons à la bosse de triage.** (5 400 mots & fig.)

1960 **621** .335 = 491 .85
Przeglad Kolejowy, janvier, p. 10.
ROMANISZYN (Z.). — Développement de la construction des **bogies-avant des locomotives électriques.** (3 700 mots & fig.)

1960 **656** .257 = 491 .85
Przeglad Kolejowy, janvier, p. 15.
GRUDZIEN (W.). — **Répartition des frais du trafic voyageurs** sur les diverses phases du processus de transport. (3 300 mots.)

1960 **614** .8 = 491 .85
Przeglad Kolejowy, janvier, p. 27.
STACHLEWSKA (L.). — **L'influence de la durée du stage professionnel sur les accidents ferroviaires.** (3 600 mots, tableaux & fig.)

1960 **625** .142 = 491 .85
Przeglad Kolejowy, février, p. 47.
KOZAK (R.). — **L'influence des vibrations dynamiques sur les traverses ferroviaires.** (2 100 mots & fig.)

1960 **625** .142 .4 = 491 .85
Przeglad Kolejowy, février, p. 51.
BASIEWICZ (T.). — **Sur la résistance à la fatigue des traverses en béton précontraint.** (1 700 mots & fig.)

1960 **656** .225 = 491 .85
Przeglad Kolejowy, février, p. 54.
WEGIERSKI (J.). — Diverses solutions aux questions de **transport de la houille sur** le trajet de la mine à **la gare expéditrice.** (4 200 mots & fig.)

1960 **625** .25 = 491 .85
Przeglad Kolejowy, février, p. 62.
ORLIK (A.). — Problèmes de rendement des **compresseurs de freins.** (3 300 mots, tableaux & fig.)

1960 **656** .212 .5 = 491 .85
Przeglad Kolejowy, mars, p. 81 (suite dans le nº d'avril.)
Débranchements et disposition générale des **gares de triage prévues pour l'automatisation.** (8 000 mots, tableaux & fig.)

1960 **625** .162 = 491 .85
Przeglad Kolejowy, mars, p. 88.
UMINSKI (W.). — Directives générales du développement des **modes de protection aux passages à niveau.** (4 200 mots & tableaux.)

1960 **625** .142 .2 = 491
Przeglad Kolejowy, mars, p. 97.
ADAMCZYK (K.). — **Propriétés fongicides des h d'imprégnation dérivées du lignite.** (1 400 mots, tabl & fig.)

1960 **625** .1 = 491
Przeglad Kolejowy, mars, p. 100.
GÓRALSKI (B.). — Sur **les formes d'organisatio progrès technique dans les constructions ferrovia** (2 900 mots.)

1960 **625** .1 = 491
Przeglad Kolejowy, avril, p. 121; mai, p. 161.
WROBEL (S.). — **Problèmes du progrès technique chemins de fer.** (7 500 mots.)

1960 **621** .431 .72 (438) = 491
Przeglad Kolejowy, avril, p. 125.
ZEMBRZUSKI (K.). — Sur le **système des locomot Diesel** prévues pour construction en Pologne. (4 800 m & fig.)

1960 **656** .212 .5 = 491
Przeglad Kolejowy, avril, p. 133.
SKAWINSKI (S.). — **Disposition générale d'une g de triage à manœuvres de wagons sur les voies à décli continue.** (2 800 mots & fig.)

In Portuguese.

Gazeta dos Caminhos de ferro. (Lisboa.)

1961 **656** .2
Gazeta dos Caminhos de ferro, nº 1762, 16 de Maio, p.
de BRITO LEAL (C.). — Os Caminhos de fe nos países longínquos. **A rede ferroviária do Pe** (2 000 palavras & mapa.)

Técnica. (Lisboa.)

1961 **624**
Técnica, março, p. 365.
BRASÃO FARINHA (J.S.). — **Cálculo de arcos sin tricos com três articulacões.** (3 000 palavras, quadr & fig.)

In Russian (= 491 .7).

Jéléznodoroznyï Transporte. (Moscou.)

1960 **656** .2 (47) = 491
Jéléznodoroznyï Transporte, janvier, p. 15.
OSINTZEV (M.A.). — Tâches septennales de l'**au mentation du rendement de travail ferroviaire en cinq an** (3 100 mots.)

1960 **621** .438 (47) = 491 .7
Jéléznodoroznyï Transporte, janvier, p. 21.
CHARGOVSKY (R.I.). — **La première locomotive soviétique à turbine à gaz.** (1 100 mots.)

1960 **313** = 491 .7
Jéléznodoroznyï Transporte, janvier, p. 23.
MYÉDVYÉDYEV (C.I.). — **Mécanisation des calculs des statistiques.** (2 700 mots.)

1960 **625** .142 .2 = 491 .7
Jéléznodoroznyï Transporte, janvier, p. 46.
ZOLOTARSKY (A.F.) et NIKIFOROVSKY (W.D.). — **Augmentation de la durée de service des traverses en bois.** (3 200 mots.)

1960 **656** .222 .4 = 491.7
Jéléznodoroznyï Transporte, janvier, p. 63.
KOULMANOV (K.A.) et CHAOUMBOURG (W. W.). — **Quelques méthodes possibles pour construire un graphique de trains.** (3 000 mots, tableaux & fig.)

1960 **625** .28 = 491 .7
Jéléznodoroznyï Transporte, février, p. 9.
MEREJKO (W.G.). — **L'organisation du service de locomotives** dans les nouveaux modes de traction. (2 100 mots & fig.)

1960 **625** .282 = 491 .7
Jéléznodoroznyï Transporte, février, p. 14.
LVOV (D.W.). — **Problème de l'unification des sous-ensembles et des détails des locomotives modernes.** (3 200 mots & fig.)

1960 **625** .244 = 491 .7
Jéléznodoroznyï Transporte, février, p. 22.
MATALASSOV (S.F.). — **Le transport des marchandises périssables** et le développement des transports frigorifiques dans le plan septennal. (3 500 mots.)

1960 **656** .21 = 491 .7
Jéléznodoroznyï Transporte, février, p. 32.
KRIVYÉNKO (Y.N.). — Nouveaux principes de **l'organisation du travail des gares et des aménagements de voies d'entrée.** (2 800 mots.)

1960 **656** .259 = 491 .7
Jéléznodoroznyï Transporte, février, p. 59.
POUCHKARYÉV (B.N.). — Schéma structurel de **l'automatisation de la commande du mouvement des trains** sur une ligne de chemins de fer. (2 200 mots & fig.)

1960 **625** .22 = 491 .7
Jéléznodoroznyï Transporte, mars, p. 10.
OSTROV (A.B.). — **Nouvelle norme d'Etat du gabarit ferroviaire.** (3 200 mots & fig.)

1960 **625** .1 = 491 .7
Jéléznodoroznyï Transporte, mars, p. 16.
LEVINE (B.I.). — Perfectionnement des **travaux de construction et de renouvellement des chemins de fer.** (2 900 mots & fig.)

1960 **656** .2 (47) = 491 .7
Jéléznodoroznyï Transporte, mars, p. 33.
Les transports ferroviaires en URSS en 1959. (*Editorial*). (3 200 mots & tableaux.)

1960 **625** .143 .2 = 491 .7
Jéléznodoroznyï Transporte, mars, p. 37.
DANILOV (W.N.). — Les méthodes propres à prolonger la **durée de vie des rails lourds.** (2 700 mots.)

1960 **625** .282 = 491 .7
Jéléznodoroznyï Transporte, mars, p. 58.
BRENKEVITCH (D.L.). — **Solutions nouvelles en matière d'exploitation et de réparations des locomotives.** (2 100 mots.)

1960 **656** .2 (47) = 491 .7
Jéléznodoroznyï Transporte, avril, p. 11.
BYÉSTCHEV (B.P.). — **Pour un nouvel essor du travail du transport ferroviaire** en U.R.S.S. pendant la deuxième année du plan septennal. (4 500 mots.)

1960 **621** .392 = 491 .7
Jéléznodoroznyï Transporte, avril, p. 30.
PATONE (B.E.). — Tâches du **développement de la technique de la soudure dans les transports.** (2 400 mots & fig.)

1960 **656** .2 = 491 .7
Jéléznodoroznyï Transporte, avril, p. 38.
CHTCHOUROV (I.W.). — Les réserves dans l'**utilisation rationnelle des matériaux et des outillages.** (3 300 mots.)

1960 **656** .25 = 491 .7
Jéléznodoroznyï Transporte, avril, p. 50.
WASILYÉV (K.A.). — **Installations de sécurité pour une période transitoire.** (2 200 mots.)

In Swedish (= 439 .71).

Järnvägs - Teknik. (Stockholm.)

1961 **625** .14 (485) = 439 .71
Järnvägs- Teknik, n° 3, p. 57.
JERBO (A.). — **Méthodes et matières d'isolation en vue d'éliminer des soulèvements lors du dégel.** (2 000 mots & fig.)

In Czech. (= 91 .886).

Železniční Doprava a Technika (Prague.)

1959 **656** .255 = 91 .886
Železniční Doprava a Technika, novembre, p. 322.
VALENTA (F.). — **Augmentation du rendement des voies uniques.** (1 700 mots & fig.)

1959 **621** .133 .1 = 91 .886
Železniční Doprava a Technika, novembre, p. 326.
STEJSKAL (J.). — Méthode graphique de **contrôle de consommation du combustible et de l'énergie dans les locomotives.** (2 300 mots & fig.)

1959 **625** .23 = 91 .886
Železniční Doprava a Technika, novembre, p. 337.
JOKL (M.). — **Application du verre avec isolement thermique dans les voitures ferroviaires.** (1 800 mots & fig.)

1959 **625** .12 = 91 .886
Železniční Doprava a Technika, décembre, p. 353.
THIEME (Th.). — Mécanisation du travail à l'**infrastructure des voies ferrées.** (2 500 mots & fig.)

1959 **625** .143 .4 = 91 .886
Železniční Doprava a Technika, décembre, p. 365.
SCHNEIDER (A.). — **Mesure du glissement des ancrages aux extrémités actives des longs rails soudés.** (2 200 mots, tableaux & fig.)

1959 **625** .144 .4 = 91 .886
Železniční Doprava a Technika, décembre, p. 370.
HLÁSNÝ (L.). — Détermination des **déformations élastiques des supports fixes de la superstructure.** (2 100 mots & fig.)

1960 **625** .242 = 91 .886
Železniční Doprava a Technika, janvier, p. 15.
REMTA (F.). — **Développement des wagons basculeurs.** (3 700 mots & fig.)

1960 **656** .225 = 91 .886
Železniční Doprava a Technika, février, p. 34.
HOUSER (M.). — Quelques observations sur la **mécanisation des processus de chargement dans les voies à usage commun.** (2 500 mots.)

1960 **621** .333 = 91 .886
Železniční Doprava a Technika, février, p. 38.
CINNER (R.), ČERNOHORSKÝ (V.) et HRUŠKA (K.). — **Echauffement des moteurs électriques,** facteur limitatif de la traction électrique. (2 900 mots, tableaux & fig.)

1960 **621** .332 = 91 .886
Železniční Doprava a Technika, février, p. 46.
CHOCHOL (B.). — **Les surtensions électriques** — leurs origine, caractère et grandeur. (2 400 mots & fig.)

1960 **656** .222 = 91 .886
Železniční Doprava a Technika, février, p. 55.
MRKVIČKA (J.). — Détermination de la valeur de la **résistance à l'avancement de longs trains.** (1 500 mots & fig.)

1960 **656** .2 = 91 .886
Železniční Doprava a Technika, mars, p. 65.
BIDLO (V.). — **L'automatisation de l'exploitation ferroviaire.** (1 700 mots.)

1960 **621** .331 = 91 .8
Železniční Doprava a Technika, mars, p. 76.
KLOSS (A.) et ZVOLANEK (Z.). — **Redresseurs ignitrons refroidis à l'air pour sous-stations ferroviaires 3 300 V.** (1 800 mots & fig.)

1960 **621** .332 = 91 .8
Železniční Doprava a Technika, mars, p. 80.
CHOCHOL (B.). — **Protection contre les surtensio** dans les installations de la traction électrique. (2 800 mo & fig.)

1960 **625** .144 .4 = 91 .8
Železniční Doprava a Technika, mars, p. 86.
MAREK (J.). — Paramètres et appréciation technic mécanique sur la **mécanisation des travaux concernant superstructure ferroviaire.** (3 200 mots & tableaux.)

1960 **656** .254 (437) = 91 .8
Železniční Doprava a Technika, avril, p. 90.
CAIS (B.). — **Systèmes de transmission de télécomm nications** par **courants porteurs** aux Chemins de fer d'Et de la Tchécoslovaquie. (4 300 mots & fig.)

1960 **625** .142 .4 = 91 .8
Železniční Doprava a Technika, avril, p. 117.
PŘEROVSKÝ (A.). — **Traverses en béton armé pr contraint,** leurs avantages et technologie de leur produ tion. (4 100 mots, tableaux & fig.)

1960 **656** .2 = 91 .8
Železniční Doprava a Technika, mai, p. 130.
SLECHTA (J.). — **L'organisation et la direction d chemins de fer.** (2 000 mots.)

1960 **621** .33 (437) = 91 .8
Železniční Doprava a Technika, mai, p. 132.
FEJT (J.). — **Développement de l'électrification** d chemins de fer en Tchécoslovaquie. (3 900 mots & fig

1960 **656** .2 (437) = 91 .8
Železniční Doprava a Technika, mai, p. 136.
ROZTOČIL (F.). — Les **communications ferroviaire** en Tchécoslovaquie depuis 1945. (1 900 mots & fig.)

1960 **625** .23/**625** .24 (437) = 91 .8
Železniční Doprava a Technika, mai, p. 144.
ZEITHAMMER (K.). — **Développement du matéri roulant et de la traction** en Tchécoslovaquie depuis 194 (3 400 mots & fig.)

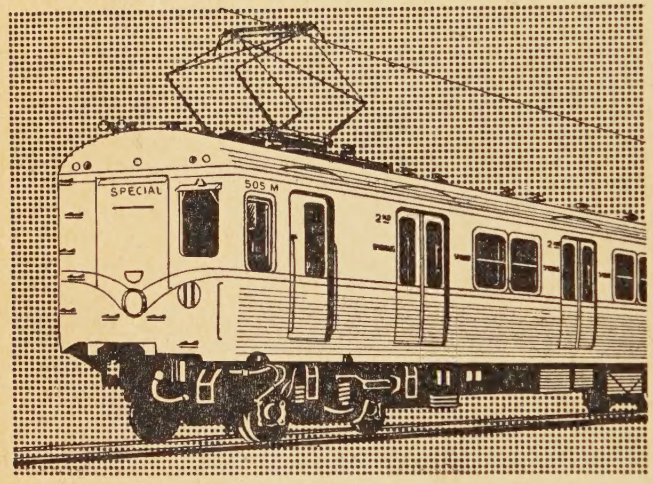
1960 **625** .1 (437) = 91 .8
Železniční Doprava a Technika, mai, p. 148.
KASÍK (G.) et TĚHNIK (V.). — **Service de la voi dans les années 1945-1960** en Tchécoslovaquie et perspe tives de développement. (2 900 mots & fig.)

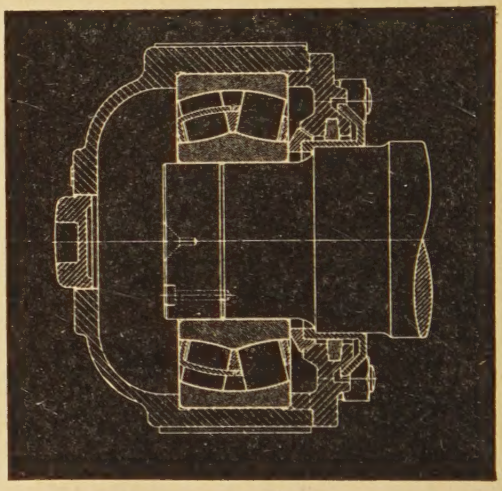
1960 **656** .25 (437) = 91 .8
Železniční Doprava a Technika, mai, p. 155.
ELÍAŠ (A.). — **Technique de la sécurité et des télécom munications dans le transport ferroviaire.** (2 300 mots.

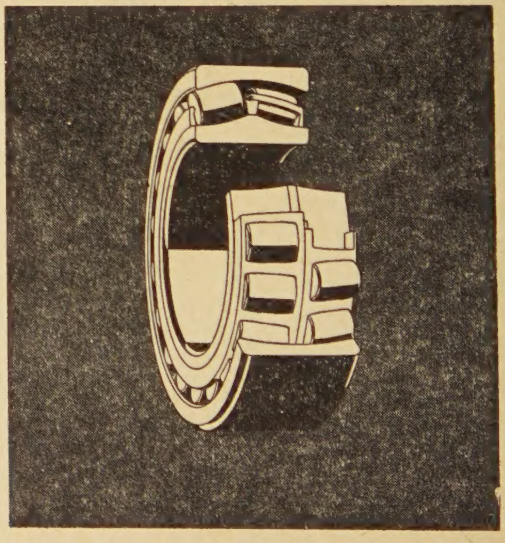
M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles

Australian suburban trains with SKF roller bearing axleboxes

Electric multiple-unit trains of the type shown here — in all, 90 motor coaches and 120 trailer coaches — have been put into service on Melbourne's suburban lines by Victorian Government Railways. During peak hours there are seven coaches in each train — three motor and four trailer. In off-peak hours, however, four-coach train sets are used, comprising two motor coaches and two trailer coaches. The maximum speed is approximately 75 m.p.h. and **all axles are fitted with SKF roller bearing axleboxes.**







SKF

SOCIETE BELGE DES ROULEMENTS A BILLES SKF S. A.

PRINTED IN BELGIUM

M. WEISSENBRUCH & Co. Ltd., Printer to the King
(Manag. Dir.: P. de Weissenbruch, 238, chaus. de Vleurgat, XL)
Edit. responsible : P. Ghilain